UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

MEMORANDUM

Date: 10/27/2020

Subject: **Broflanilide.** Occupational and Residential Exposure Assessment for the Proposed New Active Ingredient, Broflanilide.

PC Code: 283200
Decision No.: 537415
Petition No.: 7F8646
Risk Assessment Type: Occupational/Residential Exposure Assessment
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From: Shalu Shelat, Branch Chief
Risk Assessment Branch IV
Health Effects Division (7509P)

Through: Julie Van Alstine
Risk Assessment Branch VI
Health Effects Division (7509P)

and

Joshua Godshall, ExpoSAC Reviewer #1
David Nadrchal, ExpoSAC Reviewer #2
Exposure Science Advisory Committee (ExpoSAC) / HED

To: Jennifer Gaines, Chemical Review Manager
Elizabeth Fertich, Product Manager, PM4
Erik Kraft, Acting Branch Chief
Invertebrate-Vertebrate Branch 1
Registration Division (RD, 7505P)

Introduction

The Registration Division (RD) has requested that the Health Effects Division (HED) conduct an exposure and risk assessment for the new active ingredient (ai), broflanilide. This memorandum serves as HED's occupational and residential exposure and risk assessment of the proposed uses of broflanilide.

It is HED policy to use the best available data to assess exposure. Several sources of generic data were used in this assessment as surrogate data in the absence of chemical-specific data, including Pesticide Handlers Exposure Database Version 1.1 (PHED 1.1); the Agricultural Handler Exposure Task Force (AHETF) database; ExpoSAC Policy 14 and 15.2 (SOPs for Seed Treatment); and the Residential SOPs (i.e., indoor). Some of these data are proprietary, and subject to the data protection provisions of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

Note: This memorandum was reviewed by the Exposure Science Advisory Committee (ExpoSAC) on **September 12, 2019**.

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1.0 Executive Summary

Broflanilide is a new active ingredient (ai) proposed for use in a variety of indoor and outdoor use sites as an insecticide. It is proposed for control of soil-dwelling pests in corn, tuberous and corm vegetables (including potato), and cereals (including wheat) as well as various non-agricultural use sites. Broflanilide is a meta-diamide insecticide that binds to an inter-subunit allosteric site on the GABA receptor, resulting in a block of inhibitory neurotransmission, convulsions, and death of target insects. Due to its unique site of action, the Insecticide Resistance Action Committee has assigned it to a new classification (Group 30: GABA-gated chloride channel allosteric modulators).

There are 12 Section-3 labels and one EUP associated label proposed for broflanilide at this time. The proposed end-use products are formulated as liquids, water-dispersible granules, pressurized liquids, gels, foams, and granules. Agricultural uses include soil directed and incorporated use for corn grown for seed (field corn, popcorn, sweet corn) and tuberous and corm vegetables (Subgroup 1C), and seed treatment uses on small grains (wheat (all types), barley, oats, rye, triticale, amaranth grain, buckwheat (all types), cañihua, chia, cram-cram, huauzontle, quinoa, and spelt). Applications to agricultural crops can be made using ground equipment and chemigation; commercial and on-farm treatment equipment is listed for application to seeds. Application rates for the soil directed use is 0.045 lbs ai/acre and 0.00005 lbs ai/lb seed for the seed treatment use. The proposed labels contain a restricted entry interval (REI) of 12 to 24 hours.

Broflanilide end-use products are also proposed for control of flies, ants, bedbugs, cockroaches, termites and other insects inside and around industrial, commercial, and residential areas, using handheld sprayers, applicator tubes (gel formulations), aerosol cans, injection systems, and granular applicators. Maximum application rates by application type are 0.0025 lbs ai/can (aerosol can), 0.00136 lbs ai/A (liquid banded spray), 0.0033 lbs ai/acre (termiticide treatment), and 0.000004 lbs ai/void (bulb duster).

Most proposed labels include required clothing and/or personal protective equipment (PPE). Most labels required baseline attire (long pants, shoes, and socks). The agricultural labels (7969-UEG, -UEN, -URI, -URO) also require a long-sleeve shirt and chemical-resistant gloves. One label (EPA Reg No. 7969-UER) does not list any required clothing or PPE.

Based on the use pattern, there is the potential for short- and intermediate-term occupational handler dermal and inhalation exposures to broflanilide during mixing/loading and applying activities, as well as occupational post-application dermal exposure from activities performed in treated areas. There is also the potential for short-term residential post-application dermal and inhalation (adults and children) and incidental oral (children) exposures from the proposed use of broflanilide in residential areas (i.e., residential areas indoors).

The toxicology database for broflanilide is complete. All toxicity studies required under 40 CFR part 158 data requirements have been submitted. The target organs are the adrenal glands (rats, mice, and dogs) and ovaries (rats and mice). There were no parental or developmental effects reported up to the limit dose tested (1000 mg/kg/day) in the developmental studies in rats and

rabbits. In the reproduction study in rats, increased adrenal weights with corroborative histopathological findings were observed in parental rats of both sexes and generations. There is no evidence of neurotoxicity in acute or subchronic neurotoxicity studies and broflanilide is not an immunotoxic chemical. In the subchronic inhalation study, there was an increase in absolute and relative adrenal weight and increased incidence of adrenal vacuolation in both sexes and increased incidence of ovarian vacuolation.

The incidental oral POD is based on the 2-generation reproductive toxicity study selected with a No Observed Adverse Effect Level (NOAEL) of 3 mg/kg/day. An uncertainty factor of 100X (10X for interspecies extrapolation, 10X for intraspecies variation, and 1X for Food Quality Protection Act Safety Factor (FQPA SF)) was applied. No dermal hazard was identified within the route specific toxicity study up to the limit dose (1000 mg/kg/day) and the dermal absorption factor (DAF) is 5%. For the inhalation route, a route-specific inhalation study was selected for inhalation risk assessment with a No Observed Adverse Effect Concentration (NOAEC) of 31 mg/m^3 (0.031 mg/L). For inhalation exposures, the maximum total uncertainty factor of 30X (3X for interspecies extrapolation, 10X for intraspecies variation and 1X for FQPA SF) was applied.

In accordance with the EPA's *Final Guidelines for Carcinogen Risk Assessment* (March 2005), the Cancer Assessment Review Committee (CARC) classified broflanilide as "Likely to be Carcinogenic to Humans" based on Leydig cell tumors and all ovarian tumors combined (granulosa cell benign and malignant, luteomas, thecomas and sex cord stromal tumors). The CARC also recommended that quantification of risk using a linear approach (Q_1*) will be appropriate to account for all chronic toxicity, including carcinogenicity, that could result from exposure to broflanilide. The unit risk, Q_1^* $(mg/kg/day)^{-1}$, of broflanilide based upon male rat testicular Leydig cell tumor rates is 2.48×10^{-3} in human equivalents.

There is one proposed product label (EPA Reg No. 7969-UER) that does not require specific clothing or PPE that has been considered in the residential handler assessment for broflanilide, however, this product is formulated as a ready-to-use pressurized can, which, once dispensed, rapidly expands to generate a dry foam. Based on HED's 2012 Residential SOPs[1] and the low vapor pressure of broflanilide (6.7×10^{-11} mmHg), exposure is considered to be negligible. A quantitative non-cancer and cancer residential handler exposure and risk assessment has therefore, not been conducted.

Residential post-application inhalation and incidental oral exposure was assessed for the proposed applications (a dermal POD was not selected). Incidental oral exposure was assessed for indoor uses for children 1 to < 2 years old and resulted in Margins of Exposure (MOEs) ranging from 460 to 19,000 and are greater than the level of concern (LOC) of 100. Inhalation exposures and risks were assessed for the indoor proposed spot and crack and crevice uses. Inhalation risk estimates resulted in MOEs of 1,200,000 and 5,100,000 for children and adults, respectively, and are greater than the LOC of 30. Where incidental oral and inhalation exposures were combined, ARIs range from 4.6 to 51 and are greater than the LOC (i.e. the LOC is an ARI

[1] Available: http://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/standard-operating-procedures-residential-pesticide

< 1). Therefore, no non-cancer post-application risk estimates of concern were identified for children or adults from the proposed residential scenarios. An adult quantitative post-application cancer assessment was completed for the combined dermal and inhalation exposure from the proposed indoor uses of broflanilide. Cancer risk estimates range from 1×10^{-7} to 1×10^{-6}.

A dermal assessment was not completed due to lack of a dermal hazard. Occupational handler inhalation risk estimates were quantified for the proposed seed treatment, agricultural, and non-agricultural uses and do not result in non-cancer risk estimates of concern assuming baseline attire. Occupational inhalation MOEs for the non-cancer handler assessment range from 3,500 to 11,000,000 (LOC = 30) depending on the application rate, equipment, and amount handled. Occupational handler combined dermal and inhalation cancer risk estimates were also quantified for the proposed uses of broflanilide. The combined dermal and inhalation cancer risk estimates for occupational handlers range from 5×10^{-10} to 1×10^{-6} depending on application rate, equipment, and amount handled assuming baseline attire or with the addition of gloves when required by the label.

Occupational post-application exposures were not assessed for the proposed uses of broflanilide. The agricultural applications are intended for application and incorporation into the soil to control specified below-ground insects. For the remaining non-agricultural use sites (i.e., industrial areas, warehouses, etc.), commercial applicators do not typically return to the treated areas after a pesticide application; therefore, an exposure assessment was not performed for commercial/occupational applicators.

Broflanilide is classified as Toxicity Category IV via the dermal route and Toxicity Category IV for skin irritation potential. It is not a skin sensitizer. HED would recommend a REI of 12 hours. This is the minimum REI listed on the proposed labels (i.e., 12 and 24 hours) and is considered protective of post-application exposure.

Based on the Agency's current practices, a quantitative non-cancer occupational post-application inhalation exposure assessment was not performed for broflanilide at this time. If new policies or procedures are put into place, the Agency may revisit the need for a quantitative occupational post-application inhalation exposure assessment for broflanilide.

Human Studies Review

This risk assessment relies in part on data from studies in which adult human subjects were intentionally exposed to a pesticide or other chemical. These data, which include Pesticide Handlers Exposure Database Version 1.1 (PHED 1.1); the Agricultural Handler Exposure Task Force (AHETF) database; ExpoSAC Policy 14 and 15.2 (SOPs for Seed Treatment); and the Residential SOPs (i.e., indoor) are (1) subject to ethics review pursuant to 40 CFR 26, (2) have received that review, and (3) are compliant with applicable ethics requirements. For certain studies, the ethics review may have included review by the Human Studies Review Board. Descriptions of data sources, as well as guidance on their use, can be found at the Agency website[2].

[2] https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/occupational-pesticide-handler-exposure-data and https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/occupational-pesticide-post-application-exposure

2.0 Risk Assessment Conclusions and Recommendations

2.1 Summary of Risk Estimates

A residential handler assessment was not conducted due to negligible exposure from the type of formulation proposed in the case of EPA Reg No. 7969-UER. All residential post-application risk estimates for adults and children 1 to < 2 years old ranged from 460 to 5,100,000 (LOC = 100 for incidental oral and 30 for inhalation) with ARIs ranging from 4.6 to 5.1 (LOC= 1). Adult combined cancer risk estimates ranged from 1×10^{-7} to 1×10^{-6}.

Occupational non-cancer inhalation handler risk estimates ranged from assessment range from 3,500 to 11,000,000 (LOC = 30) depending on application rate, equipment, and amount handled. The combined dermal and inhalation cancer assessment for occupational handlers ranged from 5×10^{-10} to 1×10^{-6}. No dermal non-cancer nor cancer occupational post-application assessment was completed for the proposed broflanilide uses.

2.2 Label Recommendations from Occupational Assessment and Residential Assessment

None

2.3 Data Deficiencies and Requirements

None

3.0 Hazard Characterization

The toxicology database for broflanilide is complete. All toxicity studies required under 40 CFR part 158 data requirements have been submitted.

Acute Toxicity

Broflanilide has a low acute toxicity via the oral, dermal, or inhalation routes (Category IV). It is not an eye or dermal irritant (Category IV) and is not a dermal sensitizer.

Table 3.1. Acute Toxicity Profile - Broflanilide

Guideline No.	Study Type	MRID(s)	Results	Toxicity Category
870.1100	Acute Oral (rat)	50211349	LD_{50} > 5000 mg/kg (F)	IV
870.1200	Acute Dermal (rat)	50211350	LD_{50} > 5000 mg/kg (M & F)	IV
870.1300	Acute Inhalation (rat)	50211351	LC_{50} > 2.20 mg/L (M & F)	IV
870.2400	Primary Eye Irritation (rabbit)	50211353	Minimally irritating	IV
870.2500	Primary Skin Irritation (rabbit)	50211352	Non-irritating	IV
870.2600	Dermal Sensitization (mouse)	50211354	Not a sensitizer (LLNA)	N/A
		50211355	Not a sensitizer (LLNA)	N/A
	Dermal Sensitization (guinea pig)	50211356	Not a sensitizer (Maximization)	N/A
		50211496	Not a sensitizer (Maximization)	N/A

Toxicological PODs Used for Risk Assessment

The target organs are the adrenal glands (rats, mice, and dogs) and ovaries (rats and mice). Adrenal effects include increased adrenal weights, increased incidence of adrenal cortex vacuolation and adrenal cortex hypertrophy in both sexes. Ovarian effects include increased incidence of ovarian interstitial gland vacuolation.

There were no developmental effects reported up to the limit dose tested (1000 mg/kg/day) in the developmental studies in rats and rabbits. In the reproduction study in rats, increased adrenal weights with corroborative histopathological findings (increased vacuolation and diffuse hypertrophy in the adrenal gland cortex) were observed in parental rats of both sexes and generations. Offspring showed decreased pup weights in F1 and F2 pups, which occurred at a higher dose level than the observed adverse effects in parental rats. Reproductive parameters showed increased ovarian weights and increased incidence of vacuolation of the interstitial gland in the ovary at a higher dose level than the adverse effects in parental rats. There were no effects on fertility or other measured reproductive parameters. There is no evidence of increased qualitative or quantitative susceptibility in the rat and rabbit developmental toxicity studies or the 2-generation rat reproduction study. The Food Quality Protection Act (FQPA) Safety Factor (SF) has been reduced to 1X.

There is no evidence of neurotoxicity in acute or subchronic neurotoxicity studies and broflanilide is not an immunotoxic chemical. In the subchronic inhalation study, there was an increase in absolute and relative adrenal weight and increased incidence of adrenal vacuolation in both sexes and increased incidence of ovarian vacuolation.

In the chronic toxicity/carcinogenicity study in rats, there were treatment related increases in Leydig cell adenomas in males; and in luteomas and granulosa cell tumors in the ovaries, as well as in uterine adenocarcinomas, and adrenal cortex carcinomas in females. No treatment related increase in tumor incidences was observed in mice. Broflanilide is classified as "Likely to be Carcinogenic to Humans" based on Leydig cell tumors and all ovarian tumors combined (granulosa cell benign and malignant, luteomas, thecomas and sex cord stromal tumors) observed in the chronic toxicity/carcinogenicity study in rats. All mutagenicity studies were negative for both the parent and major metabolites. A quantification of risk using a linear approach (Q_1*) of broflanilide based upon male rat testicular Leydig cell tumor rates of 2.48 $x10^{-3}$ in human equivalents is applied.

Incidental and Adult Oral (Short-Term): A 2-generation reproductive toxicity study (MRID 50211379) is selected with a NOAEL of 3 mg/kg/day and a LOAEL of 8 mg/kg/day based on increased adrenal weights with corroborative histopathological findings (increased vacuolation and diffuse hypertrophy in the adrenal gland cortex) in both sexes and both generations. This study is appropriate for the route and duration of exposure as well as protective of the populations of concern (children and adults) because decreased pup weights in the F1 (↓5-7%) and F2 (↓6-10%) offspring were observed at a higher dose (127 mg/kg/day) than the dose with adverse parental findings (8 mg/kg/day). An uncertainty factor of 100X (10X for interspecies extrapolation, 10X for intraspecies variation, and 1X for FQPA SF) is applied. LOC = 100.

Dermal Exposure (Short- and Intermediate-Term): No dermal hazard was identified within the route specific toxicity study up to the limit dose (1000 mg/kg/day). No endpoint was selected for risk assessment. There is no concern for sensitivity/susceptibility in the developing or young animal. The dermal absorption factor (DAF) is 5%.

Inhalation Exposure (Short- and Intermediate-Term): A route-specific inhalation study (MRID 50211368) was selected for inhalation risk assessment with a NOAEC of 31 mg/m^3 (0.031 mg/L) and a LOAEC of 193 mg/m^3 (0.193 mg/L) based on increased adrenal weight, increased incidence of adrenal vacuolation in both sexes, increased ovarian weights and increased incidence of ovary vacuolation in females. The NOAEC is then converted to a Human Equivalent Concentration (HEC) and Human Equivalent Dose (HED) according to the Agency's Reference Concentration (RfC) 1994 Methodology.

The methods and dosimetry equations described in EPA's reference concentration (RfC) guidance (1994) are suited for calculating HECs based on the inhalation toxicity point of departure (NOAEC, LOAEC, or BMDL) for use in MOE calculations. The regional-deposited-dose ratio (RDDR), which accounts for the particulate diameter (mass median aerodynamic diameter [MMAD] and geometric standard deviation [σ_g] of aerosols), can be used to estimate the different dose fractions deposited along the respiratory tract. The RDDR is also based on interspecies differences in ventilation and respiratory-tract surface areas. Thus, the RDDR can be used to adjust an observed inhalation particulate exposure of an animal to the predicted inhalation exposure for a human. For the subchronic inhalation toxicity study with broflanilide, an RDDR was estimated at 2.959 with a MMAD of 2.0 μm and σ_g of 2.4, with extrarespiratory effects (increased adrenal weight, increased incidence of adrenal vacuolation in both sexes and increased incidence of ovary vacuolation in females) at a NOAEC of 0.031 mg/L, LOAEC of 0.193 mg/L. See Table 4.5.4.3 for a summary of HEC/HED values for broflanilide. The standard interspecies extrapolation uncertainty factor can be reduced from 10X to 3X due to the HEC calculation accounting for pharmacokinetic (not pharmacodynamic) interspecies differences. The intraspecies uncertainty factor remains at 10X. For inhalation exposures, the maximum total uncertainty factor of 30X (3X for interspecies extrapolation, 10X for intraspecies variation and 1X for FQPA SF) was applied. LOC = 30.

Cancer Classification: In accordance with the EPA's *Final Guidelines for Carcinogen Risk Assessment* (March 2005), the Cancer Assessment Review Committee (CARC) classified broflanilide as "Likely to be Carcinogenic to Humans" based on Leydig cell tumors and all ovarian tumors combined (granulosa cell benign and malignant, luteomas, thecomas and sex cord stromal tumors). There is a mode of action (MOA) submitted, the CARC concluded that overall the data provided are insufficient to support a MOA for Leydig cell testicular tumors. The CARC also recommended that quantification of risk using a linear approach (Q_1*) will be appropriate to account for all chronic toxicity, including carcinogenicity, that could result from exposure to broflanilide (M. Wilson, 09/25/2019, TXR 0057954). The unit risk, Q_1^* (mg/kg/day)$^{-1}$, of broflanilide based upon male rat testicular Leydig cell tumor rates is 2.48 x10^{-3} in human equivalents (L. Brunsman, 07/12/2019, TXR 0057900).

Table 3.2. Toxicological Doses and Endpoints for Broflanilide for Use in Dietary and Non-Occupational Human Health Risk Assessments

Exposure Scenario	Point of Departure	Uncertainty Factors/ FQPA SF	Level of Concern for Risk Assessment	Study and Toxicological Effects
Incidental Oral/ Adult Oral Short-Term (1- 30 days)	NOAEL = 3 mg/kg/day	UF_A= 10x UF_H= 10x FQPA SF= 1x	LOC for MOE < 100	2-Generation Reproduction Study in Rats (MRID 50211379) LOAEL = 8 mg/kg/day based on increased adrenal weights with corroborative histopathological findings (increased vacuolation and diffuse hypertrophy in the adrenal gland cortex) in both sexes and both generations.
Dermal Short Term (1-30 days)	A quantitative dermal risk assessment for dermal exposure is not necessary since no toxicity was observed at the limit dose in a 21-day dermal toxicity study. There is no concern for sensitivity/susceptibility in the developing or young animal.			
Inhalation Short Term (1-30 days)	NOAEC = 31 mg/m^3 (0.031 mg/L) (HEC/HED see Table 3.4)	UF_A= 3x UF_H= 10x FQPA SF= 1x	LOC for MOE <30	28-day inhalation (nose only)- rat (MRID 50211368) LOAEC= 193 mg/m^3 (0.193 mg/L), based on increased adrenal weight, increased incidence of adrenal vacuolation in both sexes, increased ovarian weights and increased incidence of ovary vacuolation in females.
Cancer	Broflanilide is classification as "Likely to be Carcinogenic to Humans" (TXR# 0057954, 09/25/2019). Q_1^*(mg/kg/day)$^{-1}$ is 2.48 X 10^{-3} based upon male rat testicular Leydig cell tumors (TXR# 0057874, 05/29/2019).			

Point of Departure (POD) = A data point or an estimated point that is derived from observed dose-response data and used to mark the beginning of extrapolation to determine risk associated with lower environmentally relevant human exposures. NOAEL/NOAEC = no observed adverse effect level/concentration. LOAEL/LOAEC = lowest observed adverse effect level/concentration. UF = uncertainty factor. UF_A = extrapolation from animal to human (intraspecies). UF_H = potential variation in sensitivity among members of the human population (interspecies). FQPA SF = FQPA Safety Factor. PAD = population adjusted dose (a = acute, c = chronic). RfD = reference dose. MOE = margin of exposure. LOC = level of concern.

Table 3.3. Toxicological Doses and Endpoints for Broflanilide for Use in Occupational Human Health Risk Assessments

Exposure Scenario	Point of Departure	Uncertainty Factors/ FQPA SF	Level of Concern for Risk Assessment	Study and Toxicological Effects
Dermal Short Term (1-30 days) and Intermediate-Term (1 – 6 months)	A quantitative dermal risk assessment for dermal exposure is not necessary since no toxicity was observed at the limit dose in a 21-day dermal toxicity study. There is no concern for sensitivity/susceptibility in the developing or young animal.			

Table 3.3. Toxicological Doses and Endpoints for Broflanilide for Use in Occupational Human Health Risk Assessments

Exposure Scenario	Point of Departure	Uncertainty Factors/ FQPA SF	Level of Concern for Risk Assessment	Study and Toxicological Effects
Inhalation Short Term (1-30 days) and Intermediate-Term (1 – 6 months)	NOAEC = 0.031 mg/L (HEC/HED see Table 34)	UF_A= 3x UF_H= 10x	LOC for MOE <30	28-day inhalation (nose only)- rat (MRID 50211368) LOAEC= 193 mg/m^3 (0.193 mg/L), based on increased adrenal weight, increased incidence of adrenal vacuolation in both sexes, increased ovarian weights and increased incidence of ovary vacuolation in females.
Cancer	Broflanilide is classification as "Likely to be Carcinogenic to Humans" (TXR# 0057954, 09/25/2019). Q_1^*(mg/kg/day)$^{-1}$ is 2.48 X 10^{-3} based upon male rat testicular Leydig cell tumors (TXR# 0057874, 05/29/2019).			

Point of Departure (POD) = A data point or an estimated point that is derived from observed dose-response data and used to mark the beginning of extrapolation to determine risk associated with lower environmentally relevant human exposures. NOAEL/NOAEC = no observed adverse effect level/concentration. LOAEL/LOAEC = lowest observed adverse effect level/concentration. UF = uncertainty factor. UF_A = extrapolation from animal to human (intraspecies). UF_H = potential variation in sensitivity among members of the human population (interspecies). MOE = margin of exposure. LOC = level of concern.

Table 3.4 Summary of HEC/HED values for broflanilide

Population	Scenario	Tox duration adjustment		HEC		HED (mg/kg-day)
		Daily	Weekly	mg/L	mg/m3	
Occupational	Handler	0.75	1	0.069	68.797	6.510
Residential	Handler	NA	NA	0.092	91.729	2.170
	Outdoor post-application	NA	NA	0.092	91.729	2.496
	Indoor Post-application	NA	0.7	0.066	65.521	1.550
	Bystander	0.25	0.7	0.016	16.380	NA

a. Toxicity duration adjustment from 6 hours/day, 5 days/week exposure in the rat inhalation study (MRID 50211368).
b. Human equivalent concentrations (HEC) calculated using duration adjustments, when applicable, and extrarespiratory effects with a reginal deposit dose ratio (RDDR) of 2.959, which was obtained with a mass median aerodynamic diameter (MMAD) of 2.0 µm and a geometric standard deviation (GSD) of 2.4 µm from the NOAEC (0.031 mg/L), with a default body weight of 187g on Wistar rats. NA = not applicable.

Absorption

A dermal absorption factor of 5% was used for the exposure assessment and is based on an *in vivo* dermal penetration study (MRID 50124620). Since the short- and intermediate-term inhalation PODs were based on route-specific toxicity studies, no absorption factors were necessary to estimate exposure.

Body Weight

The standard body weight for the general population (80 kg) was used for all adult exposure scenarios covered in this risk assessment since the endpoints selected were not developmental and/or fetal effects. 11 kg was used for all children 1 to < 2 year old scenarios.

4.0 Use Profile

Broflanilide end-use products are formulated as liquids, water-dispersible granules, pressurized liquids, gels, foams, and granules. Agricultural uses include uses on corn grown for seed (field corn, popcorn, sweet corn) and tuberous and corm vegetables (Subgroup 1C) and seed treatment uses on small grains (wheat (all types), barley, oats, rye, triticale, amaranth grain, buckwheat (all types), cañihua, chia, cram-cram, huauzontle, quinoa, and spelt). Applications to agricultural crops can be made using ground equipment; commercial and on-farm treatment equipment is listed for application to seeds. Broflanilide end-use products area also proposed for control of flies, ants, bedbugs, cockroaches, termites and other insects inside and around industrial, commercial, and residential areas, using handheld sprayers, applicator tubes (gel formulations), aerosol cans, injection systems, and granular applicators.

Agricultural use labels require long-sleeved shirts, long pants, shoes, socks, and chemical-resistant gloves. The restricted entry intervals (REIs) ranged from 12 to 24 hours. Most occupational use labels require long pants, and shoes/socks; and a few also require waterproof gloves. The comprehensive Use Profile is provided in Appendix C within the following tables: Table C.1. provides a summary of the proposed agricultural uses of broflanilide and Table C.2 provide a summary of the proposed industrial, commercial, and residential use sites of broflanilide.

5.0 Residential Exposure and Risk Estimates

There are several proposed residential uses at this time for the proposed new active ingredient, broflanilide. These uses include, but are not limited to, insecticide treatments in and around homes, apartments, schools, picnic areas, hospitals, and nursing homes. In addition, there are several proposed termiticide products that may be used around the exterior of homes, apartments, schools, and other residential use sites. The proposed uses have been assessed using HED's 2012 Residential SOPs[3] and are further discussed in Sections 5.1 and 5.2.

5.1 Residential Handler Exposure/Risk Estimates

HED uses the term "handlers" to describe those individuals who are involved in the pesticide application process. HED believes that there are distinct tasks related to applications and that exposures can vary depending on the specifics of each task. Residential handlers are addressed somewhat differently by HED as homeowners are assumed to complete all elements of an application without use of any protective equipment.

There is one proposed broflanilide product label with residential use sites (e.g., homes, apartments, mobile homes) that does not require specific clothing (e.g., long sleeved shirt/long pants) and/or personal protective equipment (PPE), and this label (EPA Reg No. 7969-UER) has been considered in the residential handler assessment for broflanilide. This product is formulated as a ready-to-use pressurized can, which, once dispensed, rapidly expands to generate

[3] Available: http://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/standard-operating-procedures-residential-pesticide

a dry foam. One ounce (weight) of the product is being dispensed in approximately 5 seconds, and the ready-to-use pressurized can produces about 1 quart of foam. Based on HED's 2012 Residential SOPs[4], there is no exposure data currently available for this type of ready-to-use foam application. However, based on the areas to which it is applied (i.e., with actuators in voids, cracks, and other places where insects harbor), dermal exposure is expected to be negligible. In addition, considering the low vapor pressure of broflanilide (6.7×10^{-11} mmHg) and formulation into foam, inhalation exposure is also expected to be negligible. Therefore, neither a quantitative non-cancer nor cancer residential handler exposure and risk assessment was conducted.

5.2 Residential Post-application Exposure/Risk Estimates

There is the potential for post-application exposure for individuals exposed as a result of being in an environment that has been previously treated with broflanilide. Due to a lack of dermal hazard for broflanilide, a dermal non-cancer assessment was not conducted. The quantitative exposure and risk assessment for residential post-application exposures is based on the following maximum application rate scenarios:

- Indoor applications with aerosol spray formulation inhalation and incidental oral exposure from crack and crevice, banded, and spot applications
    - 0.0025 lbs ai/can (7969-URT)
        - Using an injection system application for crack and crevice, void, and spot applications

In addition to the proposed use rates and the labels identified for quantitative assessment, the registrant has also proposed several labels that are not quantitatively assessed for post-application exposures as follows:

- Aerosol spray applications: There are no proposed liquid/spray formulations proposed for outdoor broadcast applications. Applications are limited to banded and spot treatments near where flies and other insects may harbor. Based on the use pattern, this use is considered to result in negligible exposure, therefore a quantitative assessment was not conducted.
- Two proposed gel formulation products (EPA Reg No. 7969-UEU and 7969-UEE): The label requires placement of pea-sized beads in area where ants and cockroaches have been seen or active, directly into cracks and crevices, or into refillable bait stations. Based on the use pattern and formulation, this use is considered to result in negligible exposure, therefore a quantitative assessment was not conducted.
- One proposed ready-to-use foam formulation (EPA Reg No. 7969-UER) to be used in and around residential structures. Based on the formulation, this use is considered to result in negligible exposure, therefore a quantitative assessment was not conducted.
- One proposed liquid formulation label (7969-URL) for an outdoor liquid termiticide application around residential structures as a spot or soil treatment including trench

[4] Available: http://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/standard-operating-procedures-residential-pesticide

treatment. Based on this limited use pattern (i.e., not broadcast outdoor treatment) and low vapor pressure (6.7×10^{-11} mmHg), post-application exposure from this use scenario is considered negligible, therefore a quantitative assessment was not conducted.

- One proposed label (EPA Reg. No. 7969-URA) includes indoor granular application including via the use of the Centrobulb® technology to release granules into voids and cracks and crevices. HED assumes that there will be negligible exposure to the granules released into the voids and crevices, therefore a quantitative assessment was not conducted.

The lifestages selected for each post-application scenario are based on an analysis provided as an Appendix in the 2012 Residential SOPs[5]. While not the only lifestage potentially exposed for these post-application scenarios, the lifestage that is included in the quantitative assessment is health protective for the exposures and risk estimates for any other potentially exposed lifestage.

Residential Post-application Exposure Data and Assumptions

A series of assumptions and exposure factors served as the basis for completing the residential post-application risk assessment. Each assumption and factor is detailed in the 2012 Residential SOPs[5].

Application Rate:

Maximum application rates for the residential post-application scenarios are reflected in Appendix C. Since this assessment is for a proposed new active ingredient, typical rates were not available for use in the cancer assessment.

Exposure Duration:

Residential exposure is expected to be short-term in duration because of the intermittent nature of applications by homeowners. Also, as summarized in the use profile within Section 4.0, the directions for use in residential settings is limited to every 28 or 30 days, therefore intermediate-term exposures are not expected but may be a series of short-term exposures. Under certain circumstances, post-application indoor inhalation following structural termiticide applications could be characterized as long-term however, due to the proposed use pattern of outdoor structural or soil injected applications as well as broflanilide's low vapor pressure (6.7×10^{-11} mmHg), long-term inhalation exposure is not expected.

Deposited Residue for Non-cancer Post-application Scenarios:

Since chemical-specific deposition data are not available and no application rate is provided on the product labels for the aerosol can applications, the default deposited residue values provided in the 2012 Residential SOPs[6] have been used based on the type of applications proposed. This spray formulation is proposed for banded, spot, crack and crevice applications indoors with the use of an injection system. No indoor broadcast uses have been proposed for the broflanilide end-use products therefore the following deposited residue values have been considered as part of this assessment:

[5] Available: http://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/standard-operating-procedures-residential-pesticide

[6] Available: http://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/standard-operating-procedures-residential-pesticide

Table 6.2.1 Default Deposited Residue by Application Type	
Type of application	**Defaults for Deposited residue (ug/cm^2)**
Perimeter/Spot/Bedbug (Pin Stream)[1]	1.1
Crack and crevice[1]	0.3

1. Represents 7969-URT

Residential Post-application Non-Cancer Exposure and Risk Equations

The algorithms used to estimate residential post-application exposure and dose can be found in the 2012 Residential SOPs[7].

Combining Exposure and Risk Estimates

The PODs for the oral and inhalation routes are based on the same effects: therefore, oral and inhalation routes can be combined. No dermal risk assessment is needed since there is no dermal hazard identified for broflanilide. Since the LOCs for both incidental oral and inhalation are different (100 and 30), the aggregate risk index (ARI) approach was used.

Aggregate Risk Index (ARI) = 1÷ [(Incidental Oral LOC ÷ Incidental Oral MOE) + (Inhalation LOC ÷ Inhalation MOE)]

Summary of Residential Post-application Non-Cancer Exposure and Risk Estimates

Incidental oral and inhalation post-application exposures and risk estimates were quantitatively assessed for the proposed uses of broflanilide. Incidental oral exposure was assessed for indoor uses for children 1 to < 2 years old and resulted in MOEs ranging from 460 to 19,000 and are greater than the LOC of 100. Inhalation exposures and risks were assessed for the indoor proposed spot and crack and crevice uses. Inhalation risk estimates resulted in MOEs of 1,200,000 and 5,100,000 for children and adults, respectively, and resulted in MOEs greater than the LOC of 30. Where incidental oral and inhalation exposures were combined, ARIs range from 4.6 to 51 and are greater than the LOC (i.e. the LOC is an ARI < 1). Therefore, no non-cancer post-application risk estimates of concern were identified for children or adults from the proposed residential scenarios.

Table 6.2.2. Residential Post-application Non-cancer Exposure and Risk Estimates for Broflanilide.

Lifestage	Post-application Exposure Scenario		Deposited Residue or Air Concentration[1]	Dose (mg/kg/day)[2]	MOEs[3]	Combined Routes (X indicates included in Combined MOE)	ARIs (incidental oral and inhalation, when applicable) LOC = 1
	Use Site	Route of Exposure					
Child 1 to < 2	Indoor Surface sprays Perimeter/Spot Pin Stream Carpet	Hand-to-Mouth	1.1 µg/cm²	0.0065	460	X	4.6
		Object-to-Mouth		0.001	3,500		NA
	Indoor Surface sprays	Hand-to-Mouth		0.0022	1,400	X	14.0

[7] http://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/standard-operating-procedures-residential-pesticide

Table 6.2.2. Residential Post-application Non-cancer Exposure and Risk Estimates for Broflanilide.

Lifestage	Post-application Exposure Scenario		Deposited Residue or Air Concentration[1]	Dose (mg/kg/day)[2]	MOEs[3]	Combined Routes (X indicates included in Combined MOE)	ARIs (incidental oral and inhalation, when applicable) LOC = 1
	Use Site	Route of Exposure					
	Perimeter/Spot Pin Stream Hard Surface	Object-to-Mouth		0.001	5,200		NA
Child 1 to < 2	Indoor Surface sprays Crack and Crevice Carpet	Hand-to-Mouth	0.3 µg/cm^2	0.0018	1,700	X	17.0
		Object-to-Mouth		0.00024	13,000		NA
	Indoor Surface sprays Crack and Crevice Hard Surface	Hand-to-Mouth		0.0006	5,100	X	50.9
		Object-to-Mouth		0.00016	19,000		NA
Child 1 to < 2	Indoor Surface Directed Sprays	Inhalation	Saturation concentration	0.0000013	1,200,000	X	Combined with individual incidental oral scenarios as indicated above
Adult				0.00000031	5,100,000		

1 Deposited residue based on default assumptions provided in 2012 Residential SOPs. Air concentration based on saturation concentration of broflanilide.
2 Dose (mg/kg/day) algorithms provided in 2012 Residential SOPs (https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/standard-operating-procedures-residential-pesticide).
3 MOE = POD (mg/kg/day) ÷ Dose (mg/kg/day). LOC for incidental oral scenarios = 100 ; LOC for inhalation scenarios = 30.
4 Aggregate Risk Index (ARI) = 1÷ [(Incidental Oral LOC ÷ Incidental Oral MOE) + (Inhalation LOC ÷ Inhalation MOE)]. LOC = 1

Residential Post-application Cancer Exposure and Risk Estimate Equations

Although a non-cancer dermal risk assessment was not performed due to the lack of an adverse effect in the non-cancer dermal study, a dermal cancer exposure and risk assessment was performed because dermal exposure does contribute to the overall cancer risk for broflanilide.

Post-application cancer risk estimates for adults were calculated using a linear low-dose extrapolation approach in which a Lifetime Average Daily Dose (LADD) is first calculated and then compared with a Q_1^* that has been calculated for broflanilide based on dose response data in the appropriate toxicology study ($Q_1^* = 2.48 \times 10^{-3}$ (mg/kg/day)$^{-1}$). The algorithms used to estimate the LADD and cancer risk for residential post-application exposure can be found in Appendix B.

Deposited Residue:

For the cancer post-application assessments, average residues are calculated to represent the potential residue and corresponding exposures for an exposure duration of an entire year. Based on the information provided on the proposed labels and that are summarized in Appendix C, the use scenarios provided on the labels limit the application or retreatment of the broflanilide products used in residential settings, both indoors and outdoors, to every 28 to 30 days. This frequency results in the use of the products in the same or repeated setting to occur approximately 12 times within a single year.

To determine the average exposure to an individual over the course of a year, HED combined the starting broflanilide depositions (deposited residues) identified for each scenario in Table 5.2.2 and input a daily dissipation each day until the next application took place. The following assumptions were incorporated into the assessment:

- A default dissipation rate (10% per day) was used for the relevant indoor and outdoor scenarios. Since no chemical specific dissipation data are available, the assessment incorporates the assumption of 10% dissipation of residues per day. Dissipation indoors is less readily understood than that which occurs outdoors, however, it is assumed that processes such as absorption of the pesticide into the carpet fiber and matting, chemical or electrostatic binding of the pesticide onto the carpet fiber surface, physical removal due to human activity (such as vacuuming), and degradation of the pesticide into non-detectable products may occur in indoor environments and lead to dissipation or a reduction in the availability of the chemical over time.
- To determine the retreatment of broflanilide in both indoor and outdoor environments, the label information was considered. Based on the information provided on the proposed labels and that are summarized in Appendix E, the use scenarios provided on the labels limit the application or retreatment of the broflanilide products used in residential settings, both indoors and outdoors, to every 28 to 30 days. This frequency results in the use of the products in the same or repeated setting to occur approximately 12 times within a single year.

Days Per Year of Exposure
The days per year of exposure varies between the outdoor and indoor application sites and routes of exposure:

- Indoor dermal exposure*:* High contact activities on carpet and hard surfaces following indoor applications: 365 days per year of exposure in the home was assessed as representative when assuming one label allowed application per 30 days (12 applications per year).

- Indoor inhalation exposure*:* 12 days of exposure based on EPA Reg. No. 7969-URT. Due to the low vapor pressure of broflanilide (6.7×10^{-11} mmHg), it is assumed that inhalation exposure would be limited to the days of application and would be negligible between application days.

Years Per Lifetime of Exposure:
It is assumed that adults would be exposed for 50 years out of a 78 year lifespan.

As a result of these considerations, for calculation of dermal exposure for the cancer assessment, the average yearly deposited residue and the resulting dermal exposure were calculated as follows:

Yearly Average deposited residue (ug/cm^2) = (∑ Day-0 deposited residue to Day 365 deposited residue) ÷ 365

when

Day X deposited residue = previous days deposited residue × e^ [(daily dissipation rate) × number of days since most recent application]

And

*Dermal LADD = **Yearly Average** dermal dose (mg/kg/day) × [days of post-app exposure (X days depending on scenario) ÷ days in a year (365)] × [years of exposure (50 years) ÷ average lifespan (78 years)]*

Summary of Residential Post-application Cancer Exposure and Risk Estimates

A quantitative cancer assessment was completed for both the combined dermal and inhalation exposure from the proposed indoor uses and only dermal exposure from the proposed outdoor broadcast uses of broflanilide. The cancer risk estimates are provided in Table 6.2.2, all cancer risk estimates range from 1×10^{-7} to 1×10^{-6}.

Table 5.2.2. Residential Post-application Cancer Exposure and Risk Estimates for Broflanilide .

Lifestage	Post-application Exposure Scenario		LADD (mg/kg/day)[1,2]	Total LADD (mg/kg/day)[3]	Cancer Risk Estimate[4]
Adult	Indoor Carpet – Perimeter/Spot (pin stream)	Dermal	5.0E-04	5.0E-04	1E-06
	Indoor Hard Surface– Perimeter/Spot (pin stream)		1.7E-04	1.7E-04	4E-07
	Indoor Carpet – Crack and Crevice		1.4E-04	1.4E-04	3E-07
	Indoor Hard Surface– Crack and Crevice		4.5E-05	4.5E-05	1E-07
	Indoor Surface Directed Sprays (spot)	Inhalation	6.45E-09	Combined with individual indoor dermal scenarios	

1 Dermal LADD (mg/kg/day) = Yearly average dermal dose (mg/kg/day) × [Days per year of exposure (days/yr) ÷ 365 days/year] × [Years per lifetime of exposure (50 yrs) ÷ Lifetime expectancy (78 yrs)].
2 Inhalation LADD (mg/kg/day) = Inhalation Dose (mg/kg/day) × [Days per year of exposure (12 days/yr) ÷ 365 days/year] × [Years per lifetime of exposure (50 yrs) ÷ Lifetime expectancy (78 yrs)].
3 Total LADD (mg/kg/day) = Dermal LADD (mg/kg/day) + Inhalation LADD (mg/kg/day), applicable only to the indoor scenarios.
4 Cancer risk estimates = Total LADD × Q_1^*, where $Q_1^* = [2.48 \times 10^{-3}]$ $(mg/kg/day)^{-1}$.

5.3 Residential Risk Estimates for Use in Aggregate Assessment

Table 5.3.1 and 5.3.2 reflect the residential risk estimates that are recommended for use in the aggregate assessment for broflanilide.

- The recommended residential exposure for use in the adult aggregate assessment is post-application inhalation exposure following an indoor surface directed spot application.
- The recommended residential exposure for use in the children 1<2 years old aggregate assessment is the combined inhalation and hand-to-mouth exposures from post-application exposure to indoor perimeter/spot coarse and pin stream surface spray applications on carpet.

Table 5.3.1. Recommendations for the Residential Exposures for the Broflanilide Non-cancer Aggregate Assessment.									
Lifestage	Exposure Scenario	Dose (mg/kg/day)[1]				MOE			MOE/ ARI[2]
		Dermal	Inhalation	Oral	Total	Dermal	Inhalation	Oral	Total
Adult	Post-Application Indoor Surface Directed Sprays (spot)	N/A	0.00000031	N/A	0.00000031	N/A	5,100,000	N/A	5,100,000 (MOE)
Child (1 to <2 years old)	Indoor Surface sprays Perimeter/ Spot Pin Stream Carpet	N/A	0.0000013	0.0065	0.0065013	N/A	1,200,000	460	4.6 (ARI)

1 Dose = the highest dose for each applicable lifestage of all residential scenarios assessed. Total = dermal + inhalation + incidental oral (where applicable).

2 MOE = the MOEs associated with the highest residential doses. Total = 1 ÷ (1/Dermal MOE) + (1/Inhalation MOE) + (1/Incidental Oral MOE), where applicable. Or Aggregate Risk Index (ARI) = 1÷ [(Incidental oral LOC ÷ Incidental MOE) + (Inhalation LOC ÷ Inhalation MOE)], where applicable.

- The recommended residential exposure for use in the adult cancer aggregate assessment is post-application dermal and inhalation exposure following an indoor surface directed perimeter/spot application.

Table 5.3.2. Recommendations for the Residential Exposures for the Broflanilide Cancer Aggregate Assessment.						
Lifestage	Exposure Scenario	LADD (mg/kg/day)[1]				Cancer Risk Estimate[2]
		Dermal	Inhalation	Oral	Total	$Q1^* = 2.48\times10^{-3}$
Adult	Indoor Carpet – Perimeter/ Spot (pin stream) 12 applications per year (per label)	5.0E-04	6.45E-09	N/A	5.0E-04	1E-06

1 LADD = the highest LADD for each applicable lifestage of all residential scenarios assessed. Total = dermal + inhalation + incidental oral (where applicable).

2 Cancer risk estimates = Total LADD × Q_1^*, where $Q_1^* = [2.48 \times 10^{-3}]$ $(mg/kg/day)^{-1}$

6.0 Non-Occupational Spray Drift Exposure and Risk Estimates

Spray drift is a potential source of exposure to those nearby pesticide applications. This is particularly the case with aerial application, but, to a lesser extent, spray drift can also be a potential source of exposure from the ground application methods (e.g., groundboom) employed for broflanilide. The Agency has been working with the Spray Drift Task Force (a task force composed of various registrants which was developed as a result of a Data Call-In issued by EPA), EPA Regional Offices and State Lead Agencies for pesticide regulation and other parties to develop the best spray drift management practices (see the Agency's Spray Drift website for more information). [8] The Agency has also developed a policy on how to appropriately consider spray drift as a potential source of exposure in risk assessments for pesticides. The potential for spray drift will be quantitatively evaluated for each pesticide during the *Registration Review* process which ensures that all uses for that pesticide will be considered concurrently. The

[8] Available: http://www.epa.gov/reducing-pesticide-drift

approach is outlined in the revised (2012) *Standard Operating Procedures For Residential Risk Assessment (SOPs) - Residential Exposure Assessment Standard Operating Procedures Addenda 1: Consideration of Spray Drift.* This document outlines the quantification of indirect non-occupational exposure to drift.

7.0 Non-Occupational Bystander Post-Application Inhalation Exposure and Risk Estimates

Volatilization of pesticides may be a source of post-application inhalation exposure to individuals nearby pesticide applications. The Agency sought expert advice and input on issues related to volatilization of pesticides from its Federal Insecticide, Fungicide, and Rodenticide Act Scientific Advisory Panel (SAP) in December 2009, and received the SAP's final report on March 2, 2010 (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2009-0687-0037). The Agency has evaluated the SAP report and has developed a Volatilization Screening Tool and a subsequent Volatilization Screening Analysis (http://www.regulations.gov/#!docketDetail;D=EPA-HQ-OPP-2014-0219).
During Registration Review, the Agency will utilize this analysis to determine if data (i.e., flux studies, route-specific inhalation toxicological studies) or further analysis is required for broflanilide.

8.0 Occupational Exposure and Risk Estimates

8.1 Occupational Handler Exposure/Risk Estimates

HED uses the term handlers to describe those individuals who are involved in the pesticide application process. HED believes that there are distinct job functions or tasks related to applications and exposures can vary depending on the specifics of each task. Job requirements (amount of chemical used in each application), the kinds of equipment used, the target being treated, and the level of protection used by a handler can cause exposure levels to differ in a manner specific to each application event.

Based on the anticipated use patterns and current labeling, types of equipment and techniques that can potentially be used, occupational handler exposure is expected from the proposed uses. In the case of broflanilide, there are both agricultural and commercial uses proposed for the occupational handler scenarios. The quantitative exposure/risk assessment developed for occupational handlers is based on the following scenarios and highest relevant single application rates for the proposed uses:

Agricultural uses:

- Mixing/loading and applying via groundboom (soil directed applications) for high- and typical acreage field crops[9]
    - 0.045 lbs ai/acre;
- Mixing/loading for chemigation (soil directed applications) for high- and typical- acreage crops
    - 0.045 lbs ai/acre;

[9] Field crop, typical= tuberous and corm vegetables (1C); field crop, high acreage = corn

- Mixer/Loader/Applicator for handheld equipment for typical acreage crops
    - 0.009 lbs ai/gal
- Commercial and on-farm seed treatment activities for small grains
    - 0.00005 lbs ai/seed

Non-agricultural uses:

- Liquid/Spray formulation
    - Applying via Ready-to-Use aerosol can in industrial, commercial, and/or residential use sites
        - Band, spot, and crack and crevice: 0.0025 lbs ai/can (7969-URT)
        - Band, spot, and crack and crevice: 0.00125 lbs ai/can (7969-URU)
        - Spot, void, and injection: 0.000056 lbs ai/can (7969-UER, Foam, negligible exposure based on formulation)
    - Applying via handheld sprayer in industrial, commercial areas, food handling establishments, poultry/animal housing, structural components (7969-URG)
        - 0.00025 lbs ai/gal
        - 0.00136 lbs ai/acre
    - Applying liquids for termiticide use in outdoor structural areas (7969-URL)
        - 0.0013 lb ai/ft^2
        - 0.0033 lbs ai/gal
    - Applying granules via a bulb duster (representing CentroBulb®; 7969-URA)
        - 0.000004 lbs ai/void

In addition to the proposed use rates and labels identified for quantitative assessment, the registrant has also proposed several labels that are not quantitatively assessed for occupational handler exposures as follows:

- Two proposed gel formulation products (EPA Reg No. 7969-UEU and 7969-UEE): The label requires placement of pea-sized beads in area where ants and cockroaches have been seen or active, directly into cracks and crevices, or into refillable bait stations. Based on the use pattern and formulation, exposure is thought to be negligible, therefore a quantitative assessment was not conducted.
- Multiple labels also include directions for refillable or removeable bait placement as part of label directions that also included broadcast or perimeter/spot applications. The broadcast and spot applications would likely result in greater exposure than exposures from refilling granular bait stations or treating an object to serve as a bait station, therefore, this scenario was not quantitatively assessed for inhalation exposure.

<u>Occupational Handler Exposure Data and Assumptions</u>

A series of assumptions and exposure factors served as the basis for completing the occupational handler risk assessments. Each assumption and factor is detailed below on an individual basis.

Application Rate:

Application rates and use parameters are summarized above and in Section 4.0.

Unit Exposures:
It is the policy of HED to use the best available data to assess handler exposure. Sources of generic handler data, used as surrogate data in the absence of chemical-specific data, include PHED 1.1, the AHETF database, or other registrant-submitted occupational exposure studies. Some of these data are proprietary (e.g., AHETF data), and subject to the data protection provisions of FIFRA. The standard values recommended for use in predicting handler exposure that are used in this assessment, known as "unit exposures", are outlined in the "Occupational Pesticide Handler Unit Exposure Surrogate Reference Table[10]", which, along with additional information on HED policy on use of surrogate data, including descriptions of the various sources, can be found at the Agency website[11]. Additional unit exposures for seed treatment are provided in Policy 14.

Area Treated or Amount Handled:
The area treated or amount handled is based on guidance in ExpoSAC Policy 9.1 and 15.2 for the seed treatment assessment. Additional information is outlined below:

Amount of Seed Treated in a Commercial Seed Treatment Facility: Vegetable crops are divided into two groups based on seed size. Based on information from the AHETF[12], there are no exact definitions, but it is generally agreed that vegetables with 10,000 or more seeds per pound are small seeded vegetables and those with 5,000 or less seeds per pound are large seeded vegetables. As there are a variety of crops represented within each crop group, the seed size correlated to pounds of seeds treated was based off of representative crops detailed in Table 8.1.1. Based on HED ExpoSAC Policy 15.2 (Table 2.1.1), the amount of seed treated per day, using the short-term duration amounts, which would be protective of intermediate-term amounts, was assumed to be:

- 360,000 lbs for cereal grain seeds

Amount of Seed Treated for On-Farm Seed Treatment: Based on HED ExpoSAC Policy 15.2 (Table 2.2.1), the amount of seed treated per day was assumed to be:

- 31,400 lbs for wheat

Amount of Seed Planted: Based on HED ExpoSAC Policy 15.2 (Table 3.1), the amount planted per day is detailed in Table 8.1.1 below.

Table 8.1.1 Amount of Seed Planted per Day.

Crop	Seed Planted (lbs)	Representative Crop
Barley	19,600	Barley
Oat	18,000	Oat
Rye	18,000	Rye

[10] Available: Available: https://www.epa.gov/sites/production/files/2020-03/documents/opp-hed-pesticide-handler-surrogate-unit-exposure-table-march-2020.pdf
[11] Available: https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/occupational-pesticide-handler-exposure-data
[12] Agricultural Handler Exposure Scenario Monograph for Commercial Seed Treatment Scenarios. Report Number AHE1008. March 2014.

Table 8.1.1 Amount of Seed Planted per Day.		
Triticale	21,800	Triticale
Wheat	31,400	Wheat

Amount handled/area treated per day: Based on HED ExpoSAC Policy 9.1 as well as standard assumptions represented in the March 2020 Occupational Pesticide Handler Exposure Calculater[13] , the amount of acres treated or amount handled was assumed to be:

- 80 acres: groundboom applications for tuberous and corm vegetables subgroup 1C
- 200 acres: groundboom applications for corn
- 1000 gallons solution: liquid mechanically-pressurized handheld applications for agricultural and non- agricultural sites
- 40 gallons solution: liquid handheld manually pressurized or backpack applications to non- agricultural sites
- 3 acres: commercial poultry/livestock areas
- 2 cans per day are handled for applications made with aerosol cans
- 30 mounds/nests per day are treated
- 10 and 100 voids: bulb duster applications indoors

Exposure Duration:
HED classifies exposures from 1 to 30 days as short-term and exposures 30 days to six months as intermediate-term. Exposure duration is determined by many things, including the exposed population, the use site, the pest pressure triggering the use of the pesticide, and the cultural practices surrounding that use site. For most agricultural uses, it is reasonable to believe that occupational handlers will not apply the same chemical every day for more than a one-month time frame; however, there may be a large agribusiness and/or commercial applicators who may apply a product over a period of weeks (e.g., completing multiple applications for multiple clients within a region). For broflanilide, based on the registered uses, short- and intermediate-term exposures are expected. For both short- and intermediate-term durations, the PODs selected are the same; therefore, risk estimates are considered protective of both durations.

Personal Protective Equipment:
Estimates of dermal and inhalation exposure were calculated for various levels of PPE. Results are presented for "baseline," defined as a single layer of clothing consisting of a long-sleeved shirt, long pants, shoes plus socks, no protective gloves, and no respirator, as well as baseline with various levels of PPE as necessary (e.g., gloves, respirator, etc.). The broflanilide product labels direct mixers, loaders, applicators and other handlers to wear baseline attire (long pants, shoes, socks). The seed treatment labels (EPA Reg No. 7969-URI and 7969-URO) and termiticide label (EPA Reg No. 7969-URL) require baseline attire with the addition of gloves.

Days per Year of Exposure:
To assess cancer risk, it is assumed that private growers would be exposed 10 days per year and commercial applicators would be exposed 30 days per year. The term "private grower" means

[13] Available: https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/occupational-pesticide-handler-exposure-data

that the grower or one of the workers would apply the pesticides to land owned or operated by the grower. The term "commercial applicators" means the applicators are completing multiple applications for multiple clients.

Years per Lifetime of Exposure:
It is assumed that handlers would be exposed for 35 years out of a 78-year lifespan.

Lifetime Expectancy:
Life expectancy values are from the Exposure Factors Handbook 2011 Edition Table 18-1 (U.S. EPA, 2011). The table shows that the overall life expectancy is 78 years based on life expectancy data from 2007. In 2007, the average life expectancy for males was 75 years and 80 years for females. Based on the available data, the recommended value for use in cancer risk assessments is 78 years.

Occupational Handler Non-Cancer Exposure and Risk Estimate Equations
The algorithms used to estimate non-cancer exposure and dose for occupational handlers can be found in Appendix A.

Combining Exposures/Risk Estimates:
No dermal risk assessment is needed since there is no dermal hazard identified therefore only a quantitative non-cancer inhalation assessment was conducted.

Summary of Occupational Handler Non-Cancer Exposure and Risk Estimates
Occupational non-cancer inhalation risk estimates were calculated for the variety of proposed use sites. MOEs for the non-cancer handler assessment range from 3,500 to 11,000,000 (LOC = 30) depending on application rate, equipment, and amount handled. The non-cancer risk estimate tables are provided in Appendix D Table D.1-D.4 and a summary of the risk estimates is as follows:

- Seed treatment
    - Inhalation MOEs range from 18,000 to 1,500,000 (LOC = 30) for all activities related to commercial and on-farm treatment of small grain seeds. Planter activities result in inhalation MOEs of 98,000 to 170,000 (LOC=30). Therefore, for seed treatment related activities, there are no risk estimates of concern at baseline attire, unless otherwise noted.
- Agricultural use on Corn and Tuberous Corm (1C)
    - Inhalation MOEs range from 6,700 to 660,000 (LOC = 30) for all activities related to the soil directed/incorporated use on corn and subgroup 1C with baseline attire. Therefore, for agricultural related activities, there are no risk estimates of concern at baseline attire.
- Non-Agricultural Uses
    - Inhalation MOEs range from 3,500 to 11,000,000 (LOC = 30) for all activities related to the non-agricultural use sites (i.e., structural void and crack and crevice, in and around warehouse, food handling establishments, industrial areas,

commercial buildings, apartments, homes, etc.). Therefore, for non-agricultural use site related activities, there are no risk estimates of concern at baseline attire.

Occupational Handler Cancer Exposure and Risk Equations

Although a non-cancer dermal risk assessment was not performed due to the lack of an adverse effect in the non-cancer dermal study, a dermal cancer exposure and risk assessment was performed because dermal exposure does contribute to the overall cancer risk for broflanilide.

Cancer risk estimates were calculated using a linear low-dose extrapolation approach in which a Lifetime Average Daily Dose (LADD) is first calculated and then compared with a Q_1* that has been calculated for broflanilide based on dose response data in the appropriate toxicology study (Q_1* = 2.48×10^{-3} $(mg/kg/day)^{-1}$). Absorbed average daily dose (ADD) levels were used as the basis for calculating the LADD values. Dermal and inhalation ADD values were first added together to obtain combined ADD values. LADD values were then calculated and compared to the Q_1* to obtain cancer risk estimates.

Summary of Occupational Handler Cancer Exposure and Risk Estimates

The combined dermal and inhalation cancer assessment for occupational handlers range from 5×10^{-10} to 3×10^{-6}, depending on application rate, equipment, and amount handled. The cancer risk estimate tables are provided in Appendix D Table D.5-D.8 and a summary of the risk estimates is as follows:

- Seed treatment
  - Total cancer risk estimates range from 1×10^{-9} to 8×10^{-8} for all activities related to commercial and on-farm treatment and planting of small grain seeds at baseline attire, unless otherwise noted.
- Agricultural use on Corn and Tuberous Corm (Subgroup 1C)
  - Total cancer risk estimates range from 5×10^{-9} to 1×10^{-6} for all activities related to the soil directed/incorporated use on corn and subgroup 1C with the label required PPE of gloves in addition to baseline attire.
- Non-Agricultural Uses
  - Total cancer risk estimates for private and commercial handlers range from 5×10^{-10} to 8×10^{-7} for all activities related to the non-agricultural use sites (i.e., rights-of-way; structural void and crack and crevice, warehouse, food handling establishments, industrial areas, golf courses, landscape turf, etc.) at baseline attire.

8.2 Occupational Post-application Exposure/Risk Estimates

HED uses the term post-application to describe exposures that occur when individuals are present in an environment that has been previously treated with a pesticide (also referred to as re-entry exposure). Such exposures may occur when workers enter previously treated areas to perform job functions, including activities related to crop production, such as scouting for pests or harvesting. Post-application exposure levels vary over time and depend on such things as the type of activity, the nature of the crop or target that was treated, the type of pesticide application,

and the chemical's degradation properties. In addition, the timing of pesticide applications, relative to harvest activities, can greatly reduce the potential for post-application exposure.

8.2.1 Occupational Post-application Inhalation Exposure/Risk Estimates

There are multiple potential sources of post-application inhalation exposure to individuals performing post-application activities in previously treated fields. These potential sources include volatilization of pesticides and resuspension of dusts and/or particulates that contain pesticides. The Agency sought expert advice and input on issues related to volatilization of pesticides from its Federal Insecticide, Fungicide, and Rodenticide Act Scientific Advisory Panel (SAP) in December 2009, and received the SAP's final report on March 2, 2010 (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2009-0687-0037). The Agency has evaluated the SAP report and has developed a Volatilization Screening Tool and a subsequent Volatilization Screening Analysis (https://www.regulations.gov/#!docketDetail;D=EPA-HQ-OPP-2014-0219). During Registration Review, the Agency will utilize this analysis to determine if data (i.e., flux studies, route-specific inhalation toxicological studies) or further analysis is required for broflanilide.

In addition, the Agency is continuing to evaluate the available post-application inhalation exposure data generated by the Agricultural Reentry Task Force. Given these two efforts, the Agency will continue to identify the need for and, subsequently, the way to incorporate occupational post-application inhalation exposure into the Agency's risk assessments.

Although a quantitative occupational post-application inhalation exposure assessment was not performed, an inhalation exposure assessment was performed for occupational/commercial handlers. Handler exposure resulting from application of pesticides outdoors is likely to result in higher exposure than post-application exposure. Therefore, it is expected that these handler inhalation exposure estimates would be protective of most occupational post-application inhalation exposure scenarios.

Commercial applicators do not typically return to the treated areas after an indoor commercial pesticide application (sites such as warehouses, food handling establishments, and hotels, etc.) and thus an occupational post-application inhalation exposure assessment was not performed for commercial applicators.

A post-application inhalation exposure assessment is not required for the seed treatment uses as exposure is expected to be negligible. Seed treatment assessments provide quantitative inhalation exposure assessments for seed treaters and secondary handlers (i.e., planters). It is expected that these exposure estimates would be protective of any potential low-level post-application inhalation exposure that could result from these types of applications.

8.2.2 Occupational Post-application Dermal Exposure/Risk Estimates

Occupational Post-application Dermal Exposure Data and Assumptions

A series of assumptions and exposure factors served as the basis for completing the occupational post-application risk assessments. In the case of broflanilide, no non-cancer dermal hazard was identified, therefore a dermal non-cancer post-application was not conducted. For the dermal cancer assessment, the agricultural applications are intended for application and incorporation into the soil to control specified below-ground insects. For this reason, it is unlikely that residues will be present on the foliar surface. Due to the lack of foliar residues, a cancer dermal post-application assessment was not conducted for the agricultural uses. For the remaining non-agricultural use sites (i.e., industrial areas, warehouses, etc.), commercial applicators do not typically return to the treated areas after a pesticide application; therefore, an exposure assessment was not performed for commercial/occupational applicators.

Restricted Entry Interval

Broflanilide is classified as Toxicity Category IV via the dermal route and Toxicity Category IV for skin irritation potential. It is not a skin sensitizer. Short- and intermediate-term post-application non-cancer risk estimates were not quantitatively assessed for post-application activities. Under 40 CFR 156.208 (c) (2), ai's classified as Acute Toxicity Category III or IV for acute dermal, eye irritation, and primary skin irritation are assigned a 12-hour REI. Therefore, the [156 subpart K] Worker Protection Statement interim REI of 12 hours is adequate to protect agricultural workers from post-application exposures to broflanilide. HED would recommend a REI of 12 hours. This is the minimum REI listed on the proposed labels (i.e., 12 and 24 hours) and is considered protective of post-application exposure.

Appendix A. Summary of Occupational and Residential Non-cancer Algorithms

Residential Non-cancer Post-application Algorithms

Post-Application Dermal Exposure Algorithm (hard surfaces and carpets)
The algorithm to calculate exposure is as follows:

$$E = TR * TC * ET * CF1$$

where:

E	= exposure (mg/day);
TR	= indoor surface transferable residue (µg/cm^2);
TC	= transfer coefficient (cm^2/hr);
ET	= exposure time (hr/day); and
CF1	= conversion factor (0.001 mg/µg).

If chemical-specific TR data are available, this is preferred and should be used to calculate exposure. However, if chemical-specific TR data are not available, then TR can be calculated using the following formula:

$$TR = DepR * F_{ai}$$

where:

TR	= indoor surface transferable residue (µg/cm^2);
DepR	= deposited residue (µg/cm^2), based on (in order of preference): (1) Chemical-specific residue deposition data (µg/cm^2), (2) Application rate (lb ai/area), or (3) Default residue based on type of application (µg/cm^2); and
F_{ai}	= fraction of ai available for transfer from carpet or hard surface (unitless).

Absorbed dermal dose, normalized to body weight, are calculated as:

$$D = \frac{E * AF}{BW}$$

where:

D	= dose (mg/kg-day);
E	= exposure (mg/day);
AF	= absorption factor; and
BW	= body weight (kg).

Table A-X: Indoor Environments (Hard Surfaces and Carpets) – Inputs for Residential Post-application Dermal Exposure				
Algorithm Notation	**Exposure Factor (units)**			**Point Estimate(s)**
TR	Transferable residue ($\mu g/cm^2$)			(1) Chemical-specific transferable residue data OR (2) Estimated: DepR * F_{ai}
DepR	Deposited residue ($\mu g/cm^2$)			(1) Chemical-specific residue deposition data, (2) Estimated based on application rate, or (3) Estimated based on default residue related to type of application
F_{ai}	Fraction of DepR as TR following application	Carpets		0.06[a]
		Hard surfaces		0.08[a]
TC	Transfer Coefficient (cm^2/hr)	Adult		6,800
		Children 1 < 2 years old		1,800
ET	Exposure Time (hrs/day)	Adults	Carpets	8
			Hard Surfaces	2
		Children 1 < 2 years old	Carpets	4
			Hard Surfaces	2
BW	Body weight (kg)	Adult		80
		Children 1 < 2 years old		11

Post-application Hand-to-Mouth Exposure Algorithm

Exposure from hand-to-mouth activity is calculated as follows (based on algorithm utilized in SHEDS-Multimedia):

$$E = \left[HR * (F_M * SA_H) * (ET * N\_Replen) * \left(1 - (1 - SE)^{\frac{Freq\ HtM}{N\_Replen}}\right)\right]$$

where:

E	= exposure (mg/day);
HR	= hand residue loading (mg/cm^2);
F_M	= fraction hand surface area mouthed / event (fraction/event);
ET	= exposure time (hr/day);
SA_H	= surface area of one hand (cm^2);
N_Replen	= number of replenishment intervals per hour (intervals/hour);
SE	= saliva extraction factor (i.e., mouthing removal efficiency); and
Freq_HtM	= number of hand-to-mouth contacts events per hour (events/hour).

and

$$HR = \frac{Fai_{hands} * DE}{SA_H * 2}$$

where:

HR	= hand residue loading (mg/cm^2);
Fai_{hands}	= fraction ai on hands compared to total surface residue from jazzercise study (unitless);
DE	= dermal exposure (mg); and
SA_H	= typical surface area of one hand (cm^2).

and

Dose, normalized to body weight, is calculated as:

$$D = \frac{E}{BW}$$

where:

D	= dose (mg/kg-day);
E	= exposure (mg/day); and
BW	= body weight (kg).

Table A-X: Indoor Environments – Inputs for Residential Post-application Hand-to-Mouth Exposure

Algorithm Notation	Exposure Factor (units)			Point Estimate(s)
Fai_{hands}	Fraction of ai on hands from jazzercise study (unitless)			0.15
DE	Dermal exposure calculated in *Section 7.2.2* (mg)			Calculated
HR	Residue available on the hands (mg/cm^2)			Calculated
SA_H	Surface area of one hand (cm^2)	Children 1 < 2 years old		150
AR	Application rate (mass active ingredient per unit area)			**See Section 4.0**
F_M	Fraction of hand mouthed per event (fraction/event)			0.13
N_Replen	Replenishment intervals per hour (intervals/hr)			4
ET	Exposure time (hours per day)	Children 1 < 2 years old	Carpets	4
			Hard Surfaces	2
SE	Saliva extraction factor (fraction)			0.48
Freq_HtM	Hand-to-mouth events per hour (events/hr)	Children 1 < 2 years old		20
BW	Body Weight (kg)	Children 1 < 2 years old		11

Post-application Object-to-Mouth Exposure Algorithm

Exposure from object-to-mouth activity is calculated as follows (based on algorithm utilized in SHEDS-Multimedia):

$$E = OR * CF1 * SAM_O * (ET * N\_Replen) * \left(1 - (1 - SE)^{\frac{Freq\_OtM}{N\_Replen}}\right)$$

where:

E	=	exposure (mg/day);
OR	=	chemical residue loading on an object (µg/cm^2);
CF1	=	weight unit conversion factor (0.001 mg/µg);
SAM_O	=	area of the object surface that is mouthed (cm^2/event);
ET	=	exposure time (hr/day);
N_Replen	=	number of replenishment intervals per hour (intervals/hour);
SE	=	saliva extraction factor (i.e., mouthing removal efficiency); and
Freq_OtM	=	number of object-to-mouth contact events per hour (events/hour).

and

$$OR = DepR * F_O$$

where:

OR	=	chemical residue loading on the object (µg/cm^2);
DepR	=	deposited residue (µg/cm^2); and
F_O	=	fraction of residue transferred to an object (unitless).

and

Oral dose, normalized to body weight, is calculated as:

$$D = \frac{E}{BW}$$

where:

D	=	dose (mg/kg-day);
E	=	exposure (mg/day); and
BW	=	body weight (kg).

Table A-X: Indoor Environments – Inputs for Residential Post-application Object-to-Mouth Exposure				
Algorithm Notation	**Exposure Factor (units)**			**Point Estimate(s)**
AR	Application rate (mass active ingredient per unit area)			**See Section 4.0**
F_O	Fraction of residue transferred to an object	Carpets		0.06[a]
		Hard surfaces		0.08[a]
SAM_O	Surface area of object mouthed (cm^2/event)			10
N_Replen	Replenishment intervals per hour (intervals/hour)			4
SE_O	Saliva extraction factor			0.48
ET	Exposure Time (hours per day)	Children 1 < 2 years old	Carpets	4
			Hard Surfaces	2
Freq_OtM	Object-to-mouth events per hour (events/hour)	Children 1 < 2 years old		14
BW	Body Weight (kg)	Children 1 < 2 years old		11

Occupational Non-cancer Handler Algorithms

Potential daily exposures for occupational handlers are calculated using the following formulas:

$$E = UE * AR * A * 0.001\ mg/ug$$

where:

E = exposure (mg ai/day),
UE = unit exposure (µg ai/lb ai),
AR = maximum application rate according to proposed label (lb ai A or lb ai/gal), and
A = area treated or amount handled (e.g., A/day, gal/day).

The daily doses are calculated using the following formula:

$$ADD = \frac{E * AF}{BW}$$

where:

ADD = average daily dose absorbed in a given scenario (mg ai/kg/day),
E = exposure (mg ai/day),
AF = absorption factor (dermal and/or inhalation), and
BW = body weight (kg).

Margin of Exposure: Non-cancer risk estimates for each application handler scenario are calculated using a Margin of Exposure (MOE), which is a ratio of the toxicological endpoint to the daily dose of concern. The daily dermal and inhalation dose received by occupational handlers are compared to the appropriate POD (i.e., NOAEL) to assess the risk to occupational handlers for each exposure route. All MOE values are calculated using the following formula:

$$MOE = \frac{POD}{ADD}$$

where:

MOE = margin of exposure: value used by HED to represent risk estimates (unitless),
POD = point of departure (mg/kg/day), and
ADD = average daily dose absorbed in a given scenario (mg ai/kg/day).

Occupational Non-cancer Post-application Algorithms

Potential daily exposures for occupational post-application workers are calculated using the following formulas:

$$DFR_t = AR * F * (1-D)^t * \left(4.54E8 \frac{ug}{lb}\right) * \left(2.47E\text{-}8 \frac{A}{cm^2}\right)$$

where:

DFR_t = dislodgeable foliage residue on day "t" (µg/cm^2),
AR = application rate (lb ai/acre),
F = fraction of ai retained on foliage or 25% (unitless),
D = fraction of residue that dissipates daily or 10% (unitless), and
t = number of days after application day (days).

$$E = TC * DFR_t * ET * 0.001 \frac{mg}{ug}$$

where:
E = exposure (mg ai/day),
TC = transfer coefficient (cm^2/hr),
DFR_t = dislodgeable foliar residue on day “t” (µg/cm^2), and
ET = exposure time (hours/day).

The daily doses are calculated using the following formula:

$$ADD = \frac{E * AF}{BW}$$

where:

ADD = average daily dose absorbed in a given scenario (mg ai/kg/day),
E = exposure (mg ai/day),
AF = absorption factor (dermal and/or inhalation), and
BW = body weight (kg).

Margin of Exposure: Non-cancer risk estimates for each scenario are calculated using a Margin of Exposure (MOE), which is a ratio of the toxicological endpoint to the daily dose of concern. The daily dermal dose received by occupational post-application workers is compared to the appropriate POD (i.e., NOAEL) to assess the risk to occupational post-application workers. All MOE values are calculated using the following formula:

$$MOE = \frac{POD}{ADD}$$

where:

MOE = margin of exposure: value used by HED to represent risk estimates (unitless),
POD = point of departure (mg/kg/day), and
ADD = average daily dose absorbed in a given scenario (mg ai/kg/day).

Appendix B. Summary of Occupational and Residential Cancer Algorithms

After the development of the ADD values, the next step required to calculate carcinogenic risk estimates is to amortize these values over the anticipated lifetime, which results in the LADD. LADD values are calculated using the following equation:

$$LADD = ADD * \frac{Days\ per\ Year\ of\ Exposure}{365\ Days\ per\ Year} * \frac{Years\ per\ Lifetime\ of\ Exposure}{Lifetime\ Expectancy}$$

where:

LADD	=	absorbed dose over a lifetime (mg ai/kg/day),
ADD	=	average daily dose absorbed in a given scenario (mg ai/kg/day),
Days per Year of Exposure	=	annual frequency of an application by an individual (days/year),
Years per Lifetime of Exposure	=	amount of a lifetime that an individual would be expected to use pesticides (years), and
Lifetime Expectancy	=	average life expectancy of an individual (years).

Cancer risk estimate calculations are completed by comparing the LADD values calculated above to the Q_1* for the chemical. Cancer risk estimates are calculated using the following equation:

$$Total\ Cancer\ Risk\ Estimate = (Dermal\ LADD + Inhalation\ LADD) * Q_1*$$

where:

Cancer Risk Estimate	=	probability of incidence of cancer cases over a lifetime (unitless),
Dermal LADD	=	absorbed dose from dermal exposure over a lifetime (mg ai/kg/day),
Inhalation LADD	=	absorbed dose from inhalation exposure over a lifetime (mg ai/kg/day), and
Q_1*	=	quantitative dose response factor used for linear, low-dose response cancer risk estimate calculations $(mg/kg/day)^{-1}$.

Appendix C. Use Profile Tables

Table C.1. Summary of Directions for Agricultural Uses of Broflanilide.

Crop/Use Site	Formulation Type	Type of Application	EPA Reg. No.	Maximum Single Application Rate	Application Equipment	PPE	REI	Use Directions and Limitations
Corn grown for seed, field corn, popcorn, sweet corn, and Tuberous and Corm Vegetables Subgroup 1C	Liquid	In-furrow T-band	7969-UEG 7969-UEN	0.045 lb ai/A 0.009 lbs ai/gal	Ground	• Long-sleeved shirt and long pants • Chemical-resistant gloves • Shoes and socks	12 hours	• Do not apply more 0.0445 lb active ingredient (ai) per acre per application and/or per year total, including seed treatment (when applicable) and soil application.
Small grains (Wheat (all types), barley, oats, rye, triticale, amaranth grain, buckwheat (all types), cañihua, chia, cram-cram, huauzontle, quinoa, and spelt)	Liquid	Commercial; On-farm Seed Treatment	7969-URO	0.00005 lb ai/lb seed	Slurry or mist-type seed treatment application equipment	• Long-sleeved shirt and long pants • Chemical-resistant gloves • Shoes and socks	24 hours	• For use in commercial seed treatment facilities using closed-system application techniques and on-farm systems with commercial or professional seed treatment application equipment only. • Do not apply directly into planter box. • For commercial and on-farm use.
			7969-URI		Slurry or mist-type seed treatment application equipment	• Long-sleeved shirt and long pants • Chemical-resistant gloves • Shoes and socks	12 hours	• Do not apply directly into planter box. • For use with commercial or professional seed treatment application equipment only in commercial facilities and on -farm. • For commercial and on-farm use.

Table C.2. Summary of Directions for Non-Agricultural Uses of Broflanilide.

Crop/Use Site	Formulation Type	Type of Application	EPA Reg. No.	Maximum Single Application Rate	Application Equipment	PPE	Use Directions and Limitations
Fly Control in Indoor areas (commercial); Animal Housing Structures; and Food/Feed Establishments	Water -soluble Granules (Applied as spray)	Spot Treatment	7969-URG	0.00025 lb ai/gal	Ground; Hand-held sprayer	• Long pants • Shoes plus socks	• **For commercial use only** • Do not contaminate food preparation surfaces, kitchen utensils, dishes, or food/feed storage containers. Cover food/feed contact surfaces and cooking utensils in treatment area before treatment or thoroughly clean after treatment and before using. • When applying as a diluted spray, apply to the point just before runoff.
		Banded		0.00025 lb ai/gal 0.00000003 lbs ai/ft^2 0.00136 lbs ai/A			
		Removable Bait Placements		0.00000003 lb ai/ ft^2 0.00025 lb ai/gal			
	RTU – Pressurized Liquid	Spot Treatment	7969-URU	0.00125 lbs ai/can	Aerosol can	• Long pants • Shoes plus socks	• Do not apply more than once every 7 days. • For spot treatment, lightly spray (to avoid runoff or dripping from target area) no further than 12 inches (30 cm) from target area at a rate of 2 linear feet per second. • For band application, spray no further than 6 inches (15 cm) from target area at a rate of 2 linear feet per second. • For application as removable bait, spray an object no larger than 24 square inches and no smaller than 6 square inches unless object is a rope or twine at least 6 inches long. • Do not contaminate food preparation surfaces, kitchen utensils, dishes, or food/feed storage containers. • Cover food/feed contact surfaces and cooking utensils in treatment area before treatment or thoroughly clean after treatment and before using. • Apply only in areas out of reach of children and pets. • Remove animals or treat in areas where animals are not present.
		Banded		0.00125 lbs ai/can			
		Removable Bait Placements					

Table C.2. Summary of Directions for Non-Agricultural Uses of Broflanilide.

Crop/Use Site	Formulation Type	Type of Application	EPA Reg. No.	Maximum Single Application Rate	Application Equipment	PPE	Use Directions and Limitations
				0.00125 lbs ai/can			
Fly Control in Indoor and Outdoor areas; and Food/Feed Establishments Ant Control in Outdoor Areas Ant Control in Indoor areas Ant Control in Food/Feed Establishments Cockroach control in Indoor and Outdoor Areas Cockroach control in Food/Feed Handling Establishments	RTU – Pressurized Liquid	Void/Crack & Crevice	7969-URT	0.0025 lb ai/can	Injection System (actuator and injection tubes)	• Long pants • Shoes plus socks	• Do not apply more than once every 7 days in commercial structures and 28 days for residential structures. • Do not use on mattresses, pillows, bed linens, or clothes. • Direct applications mainly to voids or crack and crevices. o Light infestations - Move injector tip along cracks while treating at the rate of 3 linear feet per second. o Heavy infestations - Move injector tip along at 1 linear foot per second. o Closed voids - Calculate the void's cubic area and treat at the rate of 1 to 5 seconds per three cubic feet. Several holes may be required in long-running voids. • Spot treatment is limited to one spot per room which should not exceed 2 square feet (apply at a rate of 2 seconds per 2 square feet).
		Spot Treatment		0.0025 lb ai/can	Aerosol can		

Table C.2. Summary of Directions for Non-Agricultural Uses of Broflanilide.

Crop/Use Site	Formulation Type	Type of Application	EPA Reg. No.	Maximum Single Application Rate	Application Equipment	PPE	Use Directions and Limitations
Ant Control in Indoor areas Ant Control in Food/Feed Establishments	Granular	Void/Crack & Crevice	7969-URA	0.000004 lb ai/treatment site	Bulb duster/ puffer	• Long pants • Shoes plus socks	• Indoor residential applications: Do not make more than 12 applications per year. • Food/feed establishments: Do not apply more than once every 7 days. • Apply to surfaces such as behind baseboards, under elements of construction, stainless steel equipment, shelving, machinery, storage areas, pallets, tables, chairs, and other areas where listed pests may be harboring, traveling, breeding, or entering the structure. • Cover food/feed contact surfaces and cooking utensils in treatment area before treatment or thoroughly clean after treatment and before using.
Ant Control in Indoor areas Ant Control in Food/Feed Establishments	RTU - Gel	Spot Treatment, Crack & Crevice Treatment	7969-UEU	0.0000001 lb ai/ft^2 (0.006 lb ai/A)	Applicator tube	• Long pants • Shoes plus socks	• Ant bait gels are applied in areas of activity and the amount of product used is in response to the amount of insect activity not area. • Spot treatment section states concentrate placements in areas of heavy insect activity. • For crack and crevice treatments, apply beads directly into crack and crevices where ants travel or have been seen. • Gel should be in void area, not on open or exposed surfaces. • Reapplication made when necessary. • Unwanted bait placements can be removed. • Apply only in areas that are out of reach of children and pets.

Table C.2. Summary of Directions for Non-Agricultural Uses of Broflanilide.

Crop/Use Site	Formulation Type	Type of Application	EPA Reg. No.	Maximum Single Application Rate	Application Equipment	PPE	Use Directions and Limitations
Cockroach control in Indoor Areas Cockroach control in Food/Feed Handling Establishments	RTU - Gel	Spot Treatment, Crack & Crevice	7969-UEE	0.0000006 lb ai/ft^2	Applicator tube	• Long pants • Shoes plus socks	• Apply in areas of cockroach traffic or suspected harborage. • Reapply as needed. • Apply only in areas that are out of reach of children and pets. • Do not treat food preparation surfaces or place in locations where routine cleaning might remove or transfer gel. • Gel should be in the void and not on open or exposed surfaces in a crack and crevice treatment. • Baits should always be placed in areas of insect activity and reapplied when necessary.
Termite Treatment - Food/Feed Handling Establishments Termite Treatment - In Structures (Commercial and Residential)	RTU (Foam)	Void, Spot Treatment	7969-UER	0.000056 lb ai/can	Aerosol can	None listed	• Treat gallery, harborage, and void. • Suggests drilling holes to adequately treat which would not place product on exposed surfaces. • Label directions for indoor application call for product to be applied to galleries, channels, damaged wood, harborages between structural elements of construction void, which are not exposed surfaces. • Reapplication interval is 30 days or greater.
Termite Treatment - Outdoors Around Structures (Commercial and Residential) and in Transportation Equipment	Liquid	Spot Treatment	7969-URL	0.00065 lb ai/ft trench length 0.0013 lb ai/ft^2 (0.04% dilution: 0.0033 lb ai/gal)	Hand-held sprayer; Injection equipment	• Long sleeves and long pants • Shoes plus socks • Waterproof gloves	• Do not use as a stand-alone structural protection treatment. • For post-construction use only. • Do not use indoors except for applications into structural voids.
		Soil Treatment		0.00065 lb ai/linear ft (0.0026 lb ai/ft^3 soil in trench 6" wide and 6" deep)			

Appendix D. Occupational Risk Estimates Summary Tables

Table D.1. Seed Treatment Short-Term Exposure and Risk Estimates for Broflanilide (Proposed Seed Treatment Uses: EPA Reg. No. 7969-URI and 7969-URO)

Crop	Application Rate (lb ai/lb seed)[1]	Amount of Seed Treated or Planted (lb/day)[3] *SOP 15.2*	Inhalation Unit Exposure (mg/lb ai)[2]	Inhalation Dose (mg/kg/day)[4]	Inhalation MOE (LOC = 30)[5]
Loader/Applicator (SL/G No-R)					
Small grains (Wheat (all types), barley, oats, rye, triticale, amaranth grain, buckwheat (all types), cañihua, chia, cram-cram, huauzontle, quinoa, and spelt)	0.000050	360,000	0.00034	0.000077	85,000
Sewer (SL/No G No-R)					
Small grains (Wheat (all types), barley, oats, rye, triticale, amaranth grain, buckwheat (all types), cañihua, chia, cram-cram, huauzontle, quinoa, and spelt)	0.000050	360,000	0.00023	0.000052	130,000
Bagger (SL/No G No-R)					
Small grains (Wheat (all types), barley, oats, rye, triticale, amaranth grain, buckwheat (all types), cañihua, chia, cram-cram, huauzontle, quinoa, and spelt)	0.000050	360,000	0.00016	0.000036	180,000
Multiple Activities (SL/G No-R)					
Small grains (Wheat (all types), barley, oats, rye, triticale, amaranth grain, buckwheat (all types), cañihua, chia, cram-cram, huauzontle, quinoa, and spelt)	0.000050	360,000	0.0016	0.00036	18,000
On Farm Seed Treatment (SL/G No-R)					
Small grains (Wheat (all types), barley, oats, rye, triticale, amaranth grain, buckwheat (all types), cañihua, chia, cram-cram, huauzontle, quinoa, and spelt)	0.000050	31,400	0.00219	0.0000043	1,500,000

1 Seed Treatment Application rates based on representative proposed labels, See Appendix C.
2 Unit Exposures from HED Exposure Science Advisory Council Policy 14: Standard Operating Procedures for Seed Treatment.
3 HED default for lb seed treated/planted per day from HED Exposure Science Advisory Council Policy 15.2 (March 2020).
4 Daily Inhalation Dose (mg/kg/day) = daily inhalation unit exposure (mg/lb ai) × application rate (lb ai/lb seed) × amount planted (lb seed/day) ÷ body weight (80 kg adult).
5 Inhalation MOE = Inhalation NOAEL (6.51 mg/kg/day) ÷ Inhalation Dose (mg/kg/day). Short and intermediate-term level of concern = 30.
***Crop selected from each crop group represents the most conservative value for the amount of seed treated/day.**

Table D.2. Seed Planters Short- and Intermediate-Term Exposure and Risk Estimates for Broflanilide (Proposed Seed Treatment Uses: 7969-URI and 7969-URO)						
Crop	Application Rate (lb ai/lb seed)[1]	Inhalation UE Baseline (mg/lb ai)[2]	Amount of Seed Planted (lb /A)[3]	Acres Planted (A/day) SOP 15.2[3]	Inhalation Dose (mg/kg/day)[4]	Inhalation MOE (LOC = 30)[5]
Planters (Baseline No-R)						
Barley	0.000050	0.25	19,600	200	0.000042	160,000
Oat	0.000050		18,000	200	0.000038	170,000
Rye	0.000050		18,000	200	0.000038	170,000
Triticale	0.000050		21,800	200	0.000046	140,000
Wheat	0.000050		31,400	200	0.000067	98,000

1 Seed Treatment Application rates based on representative proposed labels, See Appendix C.
2 Unit Exposures from HED Exposure Science Advisory Council Policy 14: Standard Operating Procedures for Seed Treatment (baseline inhalation = no respirator).
3 HED default for lb seed treated/planted per day from HED Exposure Science Advisory Council Policy 15.2 (March 2020).
4 Daily Inhalation Dose (mg/kg/day) = daily inhalation unit exposure (mg/lb ai) × application rate (lb ai/lb seed) × amount planted (lb seed/day) ÷ body weight (80 kg adult).
5 Inhalation MOE = Inhalation POD (6.51 mg/kg/day) ÷ Inhalation Dose (mg/kg/day). Short-term level of concern = 30.
***Crop selected from each crop group represents the most conservative value for the amount of seed planted/day**

Table D.3. Occupational Handler Non-Cancer Exposure and Risk Estimates for Broflanilide (Proposed Agricultural Uses: EPA Reg. No. 7969-UEG and 7969-UEN)									
Exposure Scenario	Crop or Target	Inhalation Unit Exposure (µg/lb ai)[1]	Level of PPE or Engineering control	Maximum Application Rate[2]	App Rate Unit	Area Treated or Amount Handled Daily[3]	Area Treated/Amount Handled Unit	Inhalation[4,5]	
								Dose (mg/kg/day)	MOE (LOC = 30)
Mixer/Loader									
Liquid, Chemigation, Broadcast	Field crop, typical	0.219	No-R	0.045	lb ai/acre	350	acres	0.0000431	150,000
Liquid, Chemigation, Broadcast	Field crop, high-acreage	0.219	No-R	0.045	lb ai/acre	350	acres	0.0000431	150,000
Liquid, Groundboom, Broadcast	Field crop, typical	0.219	No-R	0.045	lb ai/acre	80	acres	0.00000985	660,000
Liquid, Groundboom, Broadcast	Field crop, high-acreage	0.219	No-R	0.045	lb ai/acre	200	acres	0.0000246	260,000

Table D.3. Occupational Handler Non-Cancer Exposure and Risk Estimates for Broflanilide (Proposed Agricultural Uses: EPA Reg. No. 7969-UEG and 7969-UEN)

Exposure Scenario	Crop or Target	Inhalation Unit Exposure (µg/lb ai)[1]	Level of PPE or Engineering control	Maximum Application Rate[2]	App Rate Unit	Area Treated or Amount Handled Daily[3]	Area Treated/Amount Handled Unit	Inhalation[4,5]	
								Dose (mg/kg/day)	MOE (LOC = 30)
Applicator									
Spray (all starting formulations), Groundboom, Broadcast	Field crop, typical	0.34	No-R	0.045	lb ai/acre	80	acres	0.0000153	430,000
Spray (all starting formulations), Groundboom, Broadcast	Field crop, high-acreage	0.34	No-R	0.045	lb ai/acre	200	acres	0.0000383	170,000
Mixer/Loader/Applicator									
Liquid, Mechanically-pressurized Handgun, Drench/Soil-/Ground-directed	Field crop, typical	8.68	No-R	0.009	lb ai/gallon solution	1000	gallons solution	0.000976	6,700

1 Based on the "Occupational Pesticide Handler Unit Exposure Surrogate Reference Table" (https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/occupational-pesticide-handler-exposure-data); Level of mitigation: Baseline, PPE, Eng. Controls. March 2020 Version

2 Application rates based on representative proposed labels, See Appendix C.

3 Exposure Science Advisory Council Policy #9.1. Field crop, typical= tuberous and corm vegetables (1C); field crop, high acreage = corn

4 Inhalation Dose = Inhalation Unit Exposure (µg/lb ai) × Conversion Factor (0.001 mg/µg) × Application Rate (lb ai/acre or gal) × Area Treated or Amount Handled Daily (A or gal/day) ÷ BW (kg).

5 Inhalation MOE = Inhalation NOAEL (6.51 mg/kg/day) ÷ Inhalation Dose (mg/kg/day).

Table D.4. Occupational Handler Non-Cancer Exposure and Risk Estimates for Broflanilide (Proposed Non-Agricultural Uses)

Exposure Scenario	Crop or Target	Inhalation Unit Exposure (µg/lb ai)[1]	Level of PPE or Engineering control	Maximum Application Rate[2]	App Rate Unit	Area Treated or Amount Handled Daily[3]	Area Treated/Amount Handled Unit	Inhalation[4,5]	
								Dose (mg/kg/day)	MOE (LOC = 30)
Applicator									
Granule, Hand dispersal, Spot	Mounds/nests (represents a void)	380	No-R	0.000004	lb ai/(mound/nest)	30	mounds/nests	0.00000057	11,000,000
Pressurized Liquid, Aerosol can, Broadcast	Food handling establishment	1041	No-R	0.0025	lb ai/can	2	cans	0.0000651	100,000
Pressurized Liquid, Aerosol can, C&C	Food handling establishment	1041	No-R	0.0025	lb ai/can	2	cans	0.0000651	100,000
Pressurized Liquid, Aerosol can, Broadcast	Warehouse	1041	No-R	0.0025	lb ai/can	2	cans	0.0000651	100,000

Table D.4. Occupational Handler Non-Cancer Exposure and Risk Estimates for Broflanilide (Proposed Non-Agricultural Uses)									
Exposure Scenario	Crop or Target	Inhalation Unit Exposure (µg/lb ai)[1]	Level of PPE or Engineering control	Maximum Application Rate[2]	App Rate Unit	Area Treated or Amount Handled Daily[3]	Area Treated/Amount Handled Unit	Inhalation[4,5]	
								Dose (mg/kg/day)	MOE (LOC = 30)
Pressurized Liquid, Aerosol can, C&C	Warehouse	1041	No-R	0.0025	lb ai/can	2	cans	0.0000651	100,000
Pressurized Liquid, Aerosol can, Broadcast	Exterior Building Components (e.g., foundations, perimeters, door/window frames, etc.)	1041	No-R	0.0025	lb ai/can	2	cans	0.0000651	100,000
Pressurized Liquid, Aerosol can, Spot	Mounds/nests	1041	No-R	0.0025	lb ai/can	2	cans	0.0000651	100,000
Pressurized Liquid, Aerosol can, Broadcast	Residential Living Spaces (homes, apartments)	1041	No-R	0.0025	lb ai/can	2	cans	0.0000651	100,000
Pressurized Liquid, Aerosol can, C&C	Residential Living Spaces (homes, apartments)	1041	No-R	0.0025	lb ai/can	2	cans	0.0000651	100,000
Pressurized Liquid, Aerosol can, Broadcast	Childcare center/schools/institutions	1041	No-R	0.0025	lb ai/can	2	cans	0.0000651	100,000
Pressurized Liquid, Aerosol can, C&C	Childcare center/schools/institutions	1041	No-R	0.0025	lb ai/can	2	cans	0.0000651	100,000
Mixer/Loader/Applicator									
Dry Flowable, Backpack, Broadcast	Poultry house (feedline/perimeter treatment of litter, walls, etc.)	27.6	No-R	0.00136	lb ai/acre	3	acres	0.00000141	4,600,000
Dry Flowable, Backpack, Broadcast	Barn/Feedlot	27.6	No-R	0.00025	lb ai/gallon solution	40	gallons solution	0.00000345	1,900,000
Dry Flowable, Manually-pressurized Handwand, Broadcast	Food handling establishment	1044	No-R	0.00025	lb ai/gallon solution	40	gallons solution	0.00013	50,000
Dry Flowable, Manually-pressurized Handwand, C&C	Food handling establishment	1044	No-R	0.00025	lb ai/gallon solution	40	gallons solution	0.00013	50,000

Table D.4. Occupational Handler Non-Cancer Exposure and Risk Estimates for Broflanilide (Proposed Non-Agricultural Uses)									
Exposure Scenario	Crop or Target	Inhalation Unit Exposure (µg/lb ai)[1]	Level of PPE or Engineering control	Maximum Application Rate[2]	App Rate Unit	Area Treated or Amount Handled Daily[3]	Area Treated/Amount Handled Unit	Inhalation[4,5]	
								Dose (mg/kg/day)	MOE (LOC = 30)
Dry Flowable, Manually-pressurized Handwand, Broadcast	Warehouse	1044	No-R	0.00025	lb ai/gallon solution	40	gallons solution	0.00013	50,000
Dry Flowable, Manually-pressurized Handwand, C&C	Warehouse	1044	No-R	0.00025	lb ai/gallon solution	40	gallons solution	0.00013	50,000
Dry Flowable, Manually-pressurized Handwand, Broadcast	Poultry house (feedline/perimeter treatment of litter, walls, etc.)	23.6	No-R	0.00136	lb ai/acre	3	acres	0.0000012	5,400,000
Dry Flowable, Manually-pressurized Handwand, Broadcast	Barn/Feedlot	23.6	No-R	0.00025	lb ai/gallon solution	40	gallons solution	0.00000295	2,200,000
Dry Flowable, Mechanically-pressurized Handgun, Broadcast	Warehouse	45.5	No-R	0.00025	lb ai/gallon solution	1000	gallons solution	0.000143	46,000
Dry Flowable, Mechanically-pressurized Handgun, Broadcast	Poultry house (feedline/perimeter treatment of litter, walls, etc.)	45.5	No-R	0.00136	lb ai/acre	3	acres	0.00000233	2,800,000
Dry Flowable, Mechanically-pressurized Handgun, Broadcast	Barn/Feedlot	45.5	No-R	0.00025	lb ai/gallon solution	1000	gallons solution	0.000143	46,000
Liquid, Backpack, Broadcast	Structural components (e.g., walls, framing, voids, slabs, beams, lumber, etc.)	27.6	No-R	0.0033	lb ai/gallon solution	40	gallons solution	0.0000455	140,000
Liquid, Backpack, Broadcast	Exterior Building Components (e.g., foundations, perimeters,	2.58	No-R	0.0033	lb ai/gallon solution	40	gallons solution	0.00000426	1,500,000

Table D.4. Occupational Handler Non-Cancer Exposure and Risk Estimates for Broflanilide (Proposed Non-Agricultural Uses)									
Exposure Scenario	Crop or Target	Inhalation Unit Exposure (µg/lb ai)[1]	Level of PPE or Engineering control	Maximum Application Rate[2]	App Rate Unit	Area Treated or Amount Handled Daily[3]	Area Treated/Amount Handled Unit	Inhalation[4,5]	
								Dose (mg/kg/day)	MOE (LOC = 30)
	door/window frames, etc.)								
Liquid, Injection equipment, Soil injection (e.g., termiticide)	Structural components (e.g., walls, framing, voids, slabs, beams, lumber, etc.)	2.79	No-R	0.0013	lb ai/square foot	1000	square feet	0.0000454	140,000
Liquid, Manually-pressurized Handwand, Broadcast	Exterior Building Components (e.g., foundations, perimeters, door/window frames, etc.)	23.6	No-R	0.0033	lb ai/gallon solution	40	gallons solution	0.000039	170,000
Liquid, Manually-pressurized Handwand, Broadcast	Structural components (e.g., walls, framing, voids, slabs, beams, lumber, etc.)	1044	No-R	0.0033	lb ai/gallon solution	40	gallons solution	0.00173	3,800
Liquid, Mechanically-pressurized Handgun, Broadcast	Structural components (e.g., walls, framing, voids, slabs, beams, lumber, etc.)	45.5	No-R	0.0033	lb ai/gallon solution	1000	gallons solution	0.00188	3,500
Loader/Applicator									
Dust, Bulb duster, C&C	Food handling establishment	1690	No-R	0.000004	lb ai/foot (lbs ai/void)	100	feet (void)	0.00000845	770,000
Dust, Bulb duster, C&C	Warehouse	1690	No-R	0.000004	lb ai/foot (lbs ai/void)	100	feet (void)	0.00000845	770,000
Dust, Bulb duster, C&C	Residential Living Spaces (homes, apartments)	1690	No-R	0.000004	lb ai/foot (lbs ai/void)	10	feet (void)	0.000000845	7,700,000
Dust, Bulb duster, C&C	Childcare center/schools/institutions	1690	No-R	0.000004	lb ai/foot (lbs ai/void)	100	feet (void)	0.00000845	770,000

1 Based on the "Occupational Pesticide Handler Unit Exposure Surrogate Reference Table" (https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/occupational-pesticide-handler-exposure-data); Level of mitigation: Baseline, PPE, Eng. Controls. March 2020 Version

2 Application rates based on representative proposed labels, See Appendix C.

3 Exposure Science Advisory Council Policy #9.1.

4 Inhalation Dose = Inhalation Unit Exposure (µg/lb ai) × Conversion Factor (0.001 mg/µg) × Application Rate (lb ai/acre or gal) × Area Treated or Amount Handled Daily (A or gal/day) ÷ BW (kg).

5 Inhalation MOE = Inhalation NOAEL (6.51 mg/kg/day) ÷ Inhalation Dose (mg/kg/day).

Table D.5. Seed Treatment Cancer Estimates for Broflanilide (Proposed Seed Treatment Uses)								
Crop	**Application Rate (lb ai/lb seed)[1]**	**Amount of Seed Treated or Planted (lb/day)[2] *SOP 15.2***	**Dermal Unit Exposure (mg/lb ai)[3]**	**Inhalation Unit Exposure (mg/lb ai)[3]**	**Dermal Dose (mg/kg/day)[4]**	**Inhalation Dose (mg/kg/day)[4]**	**Combined Dose (mg/kg/day)[5]**	**Cancer Risk Estimate[6]**
Loader/Applicator (SL/G No-R)								
Small grains (Wheat (all types), barley, oats, rye, triticale, amaranth grain, buckwheat (all types), cañihua, chia, cram-cram, huauzontle, quinoa, and spelt)	0.000050	360,000	0.023	0.00034	0.000259	0.000077	0.00034	3E-08
Sewer (SL/No G No-R)								
Small grains (Wheat (all types), barley, oats, rye, triticale, amaranth grain, buckwheat (all types), cañihua, chia, cram-cram, huauzontle, quinoa, and spelt)	0.000050	360,000	0.0062	0.00023	0.000070	0.000052	0.00012	1E-08
Bagger (SL/No G No-R)								
Small grains (Wheat (all types), barley, oats, rye, triticale, amaranth grain, buckwheat (all types), cañihua, chia, cram-cram, huauzontle, quinoa, and spelt)	0.000050	360,000	0.0091	0.00016	0.000102	0.000036	0.00014	1E-08
Multiple Activities (SL/G No-R)								
Small grains (Wheat (all types), barley, oats, rye, triticale, amaranth grain, buckwheat (all types), cañihua, chia, cram-cram, huauzontle, quinoa, and spelt)	0.000050	360,000	0.042	0.0016	0.000473	0.00036	0.00083	8E-08

Table D.5. Seed Treatment Cancer Estimates for Broflanilide (Proposed Seed Treatment Uses)

Crop	Application Rate (lb ai/lb seed)[1]	Amount of Seed Treated or Planted (lb/day)[2] *SOP 15.2*	Dermal Unit Exposure (mg/lb ai)[3]	Inhalation Unit Exposure (mg/lb ai)[3]	Dermal Dose (mg/kg/day)[4]	Inhalation Dose (mg/kg/day)[4]	Combined Dose (mg/kg/day)[5]	Cancer Risk Estimate[6]
On Farm Seed Treatment (SL/G)								
Small grains (Wheat (all types), barley, oats, rye, triticale, amaranth grain, buckwheat (all types), cañihua, chia, cram-cram, huauzontle, quinoa, and spelt)	0.000050	31,400	0.0376	0.000219	0.000037	0.0000043	0.00004	1E-09

1 Seed Treatment Application rates based on representative labels summarized in Appendix C.
2 HED default for lb seed treated/planted per day from HED Exposure Science Advisory Council Policy 15.2 (March 2020).
3 Unit Exposures from HED Exposure Science Advisory Council Policy 14: Standard Operating Procedures for Seed Treatment.
4 Daily Dermal or Inhalation Dose (mg/kg/day) = daily dermal or inhalation unit exposure (mg/lb ai) × application rate (lb ai/lb seed) × amount planted (lb seed/day) ÷ body weight (80 kg adult).
5 Combined Dose (mg/kg/day) = Daily Dermal Dose (mg/kg/day) + Daily Inhalation Dose (mg/kg/day)
6 Cancer risk estimate = ([Combined Dose (mg/kg/day)] × [Days per year of exposure (10 (on farm) or 30 days/yr (commercial)) / 365 days/year] × [Years per lifetime of exposure (35 yrs) ÷ Lifetime expectancy (78yrs)]) × Q_1^*, where $Q_1^* = 2.48\times10^{-3}$ $(mg/kg/day)^{-1}$

Table D.6. Seed Planters Cancer Risk Estimates for Broflanilide (Proposed Seed Treatment Uses)

Crop	Application Rate (lb ai/lb seed)[1]	Dermal UE Baseline (mg/lb ai)[2]	Inhalation UE Baseline (mg/lb ai)[2]	Amount of Seed Planted (lb /A)[3]	Acres Planted (A/day) SOP 15.2[3]	Dermal Dose (mg/kg/day)[4]	Inhalation Dose (mg/kg/day)[4]	Combined Dose (mg/kg/day)[5]	Cancer Risk Estimate[6]
Planters (Baseline No-R)									
Barley	0.000050	0.0034	0.25	19,600	200	0.000153	0.000042	0.000195	2E-08
Oat				18,000	200	0.000141	0.000038	0.000179	2E-08
Rye				18,000	200	0.000141	0.000038	0.000179	2E-08
Triticale				21,800	200	0.000170	0.000046	0.000217	2E-08
Wheat				31,400	200	0.000245	0.000067	0.000312	3E-08

1 Seed Treatment Application rates based on representative labels summarized in Appendix C.
2 Unit Exposures from HED Exposure Science Advisory Council Policy 14: Standard Operating Procedures for Seed Treatment.
3 HED default for lb seed treated/planted per day from HED Exposure Science Advisory Council Policy 15.2 (December 2017).
4 Daily Dermal or Inhalation Dose (mg/kg/day) = daily dermal or inhalation unit exposure (mg/lb ai) × application rate (lb ai/lb seed) × amount planted (lb seed/day) ÷ body weight (80 kg adult).
5 Combined Dose (mg/kg/day) = Daily Dermal Dose (mg/kg/day) + Daily Inhalation Dose (mg/kg/day)
6 Cancer risk estimate = ([Combined Dose (mg/kg/day)] × [Days per year of exposure (30 days/yr) / 365 days/year] × [Years per lifetime of exposure (35 yrs) ÷ Lifetime expectancy (78yrs)]) × Q_1^*, where $Q_1^* = 2.48\times10^{-3}$ $(mg/kg/day)^{-1}$

Table D.7. Occupational Handler Cancer Exposure and Risk Estimates for Broflanilide (Proposed Agricultural Uses: 7969-UEG and 7969-UEN)

Exposure Scenario	Crop or Target	Private Handler						Commercial Handler					
		LADD (mg/kg/day)				Total LADD [1,2,3]	Cancer Risk Estimate[4]	LADD (mg/kg/day)				Total LADD [1,2,3]	Cancer Risk Estimate[4]
		Dermal	PPE	Inhalation	PPE			Dermal	PPE	Inhalation	PPE		
Mixer/Loader													
Liquid, Chemigation, Broadcast	Field crop, typical	0.00000455	SL/G	0.00000053	No-R	0.00000508	1E-08	0.0000136	SL/G	0.00000159	No-R	0.0000152	4E-08
Liquid, Chemigation, Broadcast	Field crop, high-acreage	0.00000455	SL/G	0.00000053	No-R	0.00000508	1E-08	0.0000136	SL/G	0.00000159	No-R	0.0000152	4E-08
Liquid, Groundboom, Broadcast	Field crop, typical	0.00000104	SL/G	0.000000121	No-R	0.00000116	3E-09	0.00000311	SL/G	0.000000363	No-R	0.00000348	9E-09
Liquid, Groundboom, Broadcast	Field crop, high-acreage	0.00000259	SL/G	0.000000302	No-R	0.0000029	7E-09	0.00000778	SL/G	0.000000907	No-R	0.0000087	2E-08
Applicator													
Spray (all starting formulations), Groundboom, Broadcast	Field crop, typical	0.000000446	SL/G	0.000000188	No-R	0.00000063	2E-09	0.00000134	SL/G	0.000000564	No-R	0.0000019	5E-09
Spray (all starting formulations), Groundboom, Broadcast	Field crop, high-acreage	0.00000111	SL/G	0.000000471	No-R	0.00000159	4E-09	0.00000334	SL/G	0.00000141	No-R	0.00000476	1E-08
Mixer/Loader/Applicator													
Liquid, Mechanically-pressurized Handgun, Drench/Soil-/Ground-directed	Field crop, typical	0.000143	SL/G	0.000012	No-R	0.000155	4E-07	0.000428	SL/G	0.000036	No-R	0.000465	1E-06

1 Dermal LADD (mg/kg/day) = Dermal dose (mg/kg/day) × [Days per year of exposure (10 or 30 days/yr) ÷ 365 days/year] × [Years per lifetime of exposure (35 yrs) ÷ Lifetime expectancy (78 yrs)].
2 Inhalation LADD (mg/kg/day) = Inhalation Dose (mg/kg/day) × [Days per year of exposure (10 or 30 days/yr) / 365 days/year] × [Years per lifetime of exposure (35 yrs) ÷ Lifetime expectancy (78 yrs)].
3 Total LADD (mg/kg/day) = Dermal LADD (mg/kg/day) + Inhalation LADD (mg/kg/day).
4 Cancer risk estimates = Total LADD × Q_1^*, where $Q_1^* = [2.48\times10^{-3}]$ $(mg/kg/day)^{-1}$

Table D.8. Occupational Handler Cancer Exposure and Risk Estimates for Broflanilide (Proposed Non-Agricultural Uses)													
Exposure Scenario	Crop or Target	Private Handler						Commercial Handler					
		LADD (mg/kg/day)				Total LADD [1,2,3]	Cancer Risk Estimate[4]	LADD (mg/kg/day)				Total LADD [1,2,3]	Cancer Risk Estimate[4]
		Dermal	PPE	Inhalation	PPE			Dermal	PPE	Inhalation	PPE		
Applicator													
Granule, Hand dispersal, Spot	Mounds/nests (represents a void)	0.000000096	SL/NoG	7.01E-09	No-R	0.000000103	3E-10	0.000000288	SL/NoG	0.000000021	No-R	0.000000309	8E-10
Pressurized Liquid, Aerosol can, Broadcast	Food handling establishment	0.0000073	SL/NoG	0.0000008	No-R	0.0000081	2E-08	0.0000219	SL/NoG	0.0000024	No-R	0.0000243	6E-08
Pressurized Liquid, Aerosol can, C&C	Food handling establishment	0.0000073	SL/NoG	0.0000008	No-R	0.0000081	2E-08	0.0000219	SL/NoG	0.0000024	No-R	0.0000243	6E-08
Pressurized Liquid, Aerosol can, Broadcast	Warehouse	0.0000073	SL/NoG	0.0000008	No-R	0.0000081	2E-08	0.0000219	SL/NoG	0.0000024	No-R	0.0000243	6E-08
Pressurized Liquid, Aerosol can, C&C	Warehouse	0.0000073	SL/NoG	0.0000008	No-R	0.0000081	2E-08	0.0000219	SL/NoG	0.0000024	No-R	0.0000243	6E-08
Pressurized Liquid, Aerosol can, Broadcast	Exterior Building Components (e.g., foundations, perimeters, door/window frames, etc.)	0.0000073	SL/NoG	0.0000008	No-R	0.0000081	2E-08	0.0000219	SL/NoG	0.0000024	No-R	0.0000243	6E-08
Pressurized Liquid, Aerosol can, Spot	Mounds/nests	0.0000073	SL/NoG	0.0000008	No-R	0.0000081	2E-08	0.0000219	SL/NoG	0.0000024	No-R	0.0000243	6E-08
Pressurized Liquid, Aerosol can, Broadcast	Residential Living Spaces (homes, apartments)	0.0000073	SL/NoG	0.0000008	No-R	0.0000081	2E-08	0.0000219	SL/NoG	0.0000024	No-R	0.0000243	6E-08
Pressurized Liquid, Aerosol can, C&C	Residential Living Spaces (homes, apartments)	0.0000073	SL/NoG	0.0000008	No-R	0.0000081	2E-08	0.0000219	SL/NoG	0.0000024	No-R	0.0000243	6E-08
Pressurized Liquid, Aerosol can, Broadcast	Childcare center/schools/institutions	0.0000073	SL/NoG	0.0000008	No-R	0.0000081	2E-08	0.0000219	SL/NoG	0.0000024	No-R	0.0000243	6E-08

Table D.8. Occupational Handler Cancer Exposure and Risk Estimates for Broflanilide (Proposed Non-Agricultural Uses)													
Exposure Scenario	Crop or Target	Private Handler						Commercial Handler					
		LADD (mg/kg/day)				Total LADD [1,2,3]	Cancer Risk Estimate[4]	LADD (mg/kg/day)				Total LADD [1,2,3]	Cancer Risk Estimate[4]
		Dermal	PPE	Inhalation	PPE			Dermal	PPE	Inhalation	PPE		
Pressurized Liquid, Aerosol can, C&C	Childcare center/schools/institutions	0.0000073	SL/No G	0.0000008	No-R	0.0000081	2E-08	0.0000219	SL/No G	0.0000024	No-R	0.0000243	6E-08
Mixer/Loader/Applicator													
Dry Flowable, Backpack, Broadcast	Poultry house (feedline/perimeter treatment of litter, walls, etc.)	7.84E-08	SL/No G	1.73E-08	No-R	9.58E-08	2E-10	0.000000235	SL/No G	0.000000052	No-R	0.000000287	7E-10
Dry Flowable, Backpack, Broadcast	Barn/Feedlot	0.000000193	SL/No G	4.24E-08	No-R	0.000000236	6E-10	0.000000579	SL/No G	0.000000127	No-R	0.000000708	2E-09
Dry Flowable, Manually-pressurized Handwand, Broadcast	Food handling establishment	0.00000223	SL/No G	0.0000016	No-R	0.00000382	9E-09	0.00000668	SL/No G	0.00000479	No-R	0.0000115	3E-08
Dry Flowable, Manually-pressurized Handwand, C&C	Food handling establishment	0.00000223	SL/No G	0.0000016	No-R	0.00000382	9E-09	0.00000668	SL/No G	0.00000479	No-R	0.0000115	3E-08
Dry Flowable, Manually-pressurized Handwand, Broadcast	Warehouse	0.00000223	SL/No G	0.0000016	No-R	0.00000382	9E-09	0.00000668	SL/No G	0.00000479	No-R	0.0000115	3E-08
Dry Flowable, Manually-pressurized Handwand, C&C	Warehouse	0.00000223	SL/No G	0.0000016	No-R	0.00000382	9E-09	0.00000668	SL/No G	0.00000479	No-R	0.0000115	3E-08
Dry Flowable, Manually-pressurized Handwand, Broadcast	Poultry house (feedline/perimeter treatment of litter, walls, etc.)	0.00000313	SL/No G	1.48E-08	No-R	0.00000315	8E-09	0.0000094	SL/No G	4.43E-08	No-R	0.00000944	2E-08

Table D.8. Occupational Handler Cancer Exposure and Risk Estimates for Broflanilide (Proposed Non-Agricultural Uses)

Exposure Scenario	Crop or Target	Private Handler						Commercial Handler					
		LADD (mg/kg/day)				Total LADD [1,2,3]	Cancer Risk Estimate[4]	LADD (mg/kg/day)				Total LADD [1,2,3]	Cancer Risk Estimate[4]
		Dermal	PPE	Inhalation	PPE			Dermal	PPE	Inhalation	PPE		
Dry Flowable, Manually-pressurized Handwand, Broadcast	Barn/Feedlot	0.00000768	SL/NoG	3.63E-08	No-R	0.00000772	2E-08	0.0000231	SL/NoG	0.000000109	No-R	0.0000232	6E-08
Dry Flowable, Mechanically-pressurized Handgun, Broadcast	Warehouse	0.00000345	SL/NoG	0.00000176	No-R	0.00000521	1E-08	0.0000104	SL/NoG	0.00000527	No-R	0.0000156	4E-08
Dry Flowable, Mechanically-pressurized Handgun, Broadcast	Poultry house (feedline/perimeter treatment of litter, walls, etc.)	5.64E-08	SL/NoG	2.86E-08	No-R	8.51E-08	2E-10	0.000000169	SL/NoG	8.59E-08	No-R	0.000000255	6E-10
Dry Flowable, Mechanically-pressurized Handgun, Broadcast	Barn/Feedlot	0.00000345	SL/NoG	0.00000176	No-R	0.00000521	1E-08	0.0000104	SL/NoG	0.00000527	No-R	0.0000156	4E-08
Liquid, Backpack, Broadcast	Structural components (e.g., walls, framing, voids, slabs, beams, lumber, etc.)	0.00000254	SL/NoG	0.000000559	No-R	0.00000311	8E-09	0.00000763	SL/NoG	0.00000168	No-R	0.00000933	2E-08
Liquid, Backpack, Broadcast	Exterior Building Components (e.g., foundations, perimeters, door/window frames, etc.)	0.00000837	SL/NoG	5.24E-08	No-R	0.00000842	2E-08	0.0000251	SL/NoG	0.000000157	No-R	0.0000253	6E-08
Liquid, Injection equipment, Soil injection (e.g., termiticide)	Structural components (e.g., walls, framing, voids, slabs, beams, lumber, etc.)	0.000013	SL/NoG	0.000000558	No-R	0.0000136	3E-08	0.0000391	SL/NoG	0.00000167	No-R	0.0000409	1E-07
Liquid, Manually-pressurized Handwand, Broadcast	Exterior Building Components (e.g., foundations, perimeters, door/window frames, etc.)	0.000101	SL/NoG	0.000000479	No-R	0.000102	3E-07	0.000304	SL/NoG	0.00000144	No-R	0.000306	8E-07

Table D.8. Occupational Handler Cancer Exposure and Risk Estimates for Broflanilide (Proposed Non-Agricultural Uses)

Exposure Scenario	Crop or Target	Private Handler						Commercial Handler					
		LADD (mg/kg/day)				Total LADD [1,2,3]	Cancer Risk Estimate[4]	LADD (mg/kg/day)				Total LADD [1,2,3]	Cancer Risk Estimate[4]
		Dermal	PPE	Inhalation	PPE			Dermal	PPE	Inhalation	PPE		
Liquid, Manually-pressurized Handwand, Broadcast	Structural components (e.g., walls, framing, voids, slabs, beams, lumber, etc.)	0.0000294	SL/NoG	0.0000213	No-R	0.0000506	1E-07	0.0000881	SL/NoG	0.0000638	No-R	0.000152	4E-07
Liquid, Mechanically-pressurized Handgun, Broadcast	Structural components (e.g., walls, framing, voids, slabs, beams, lumber, etc.)	0.0000456	SL/NoG	0.0000231	No-R	0.0000687	2E-07	0.000137	SL/NoG	0.0000693	No-R	0.000206	5E-07
Loader/Applicator													
Dust, Bulb duster, C&C	Food handling establishment	0.00000051	SL/NoG	0.000000104	No-R	0.000000615	2E-09	0.00000153	SL/NoG	0.000000312	No-R	0.00000184	5E-09
Dust, Bulb duster, C&C	Warehouse	0.00000051	SL/NoG	0.000000104	No-R	0.000000615	2E-09	0.00000153	SL/NoG	0.000000312	No-R	0.00000184	5E-09
Dust, Bulb duster, C&C	Residential Living Spaces (homes, apartments)	0.000000051	SL/NoG	1.04E-08	No-R	6.15E-08	2E-10	0.000000153	SL/NoG	3.12E-08	No-R	0.000000184	5E-10
Dust, Bulb duster, C&C	Childcare center/schools/institutions	0.00000051	SL/NoG	0.000000104	No-R	0.000000615	2E-09	0.00000153	SL/NoG	0.000000312	No-R	0.00000184	5E-09

1 Dermal LADD (mg/kg/day) = Dermal dose (mg/kg/day) × [Days per year of exposure (10 or 30 days/yr) ÷ 365 days/year] × [Years per lifetime of exposure (35 yrs) ÷ Lifetime expectancy (78 yrs)].
2 Inhalation LADD (mg/kg/day) = Inhalation Dose (mg/kg/day) × [Days per year of exposure (10 or 30 days/yr) / 365 days/year] × [Years per lifetime of exposure (35 yrs) ÷ Lifetime expectancy (78 yrs)].
3 Total LADD (mg/kg/day) = Dermal LADD (mg/kg/day) + Inhalation LADD (mg/kg/day).
4 Cancer risk estimates = Total LADD × Q_1^*, where $Q_1^* = [2.48\times10^{-3}]$ $(mg/kg/day)^{-1}$